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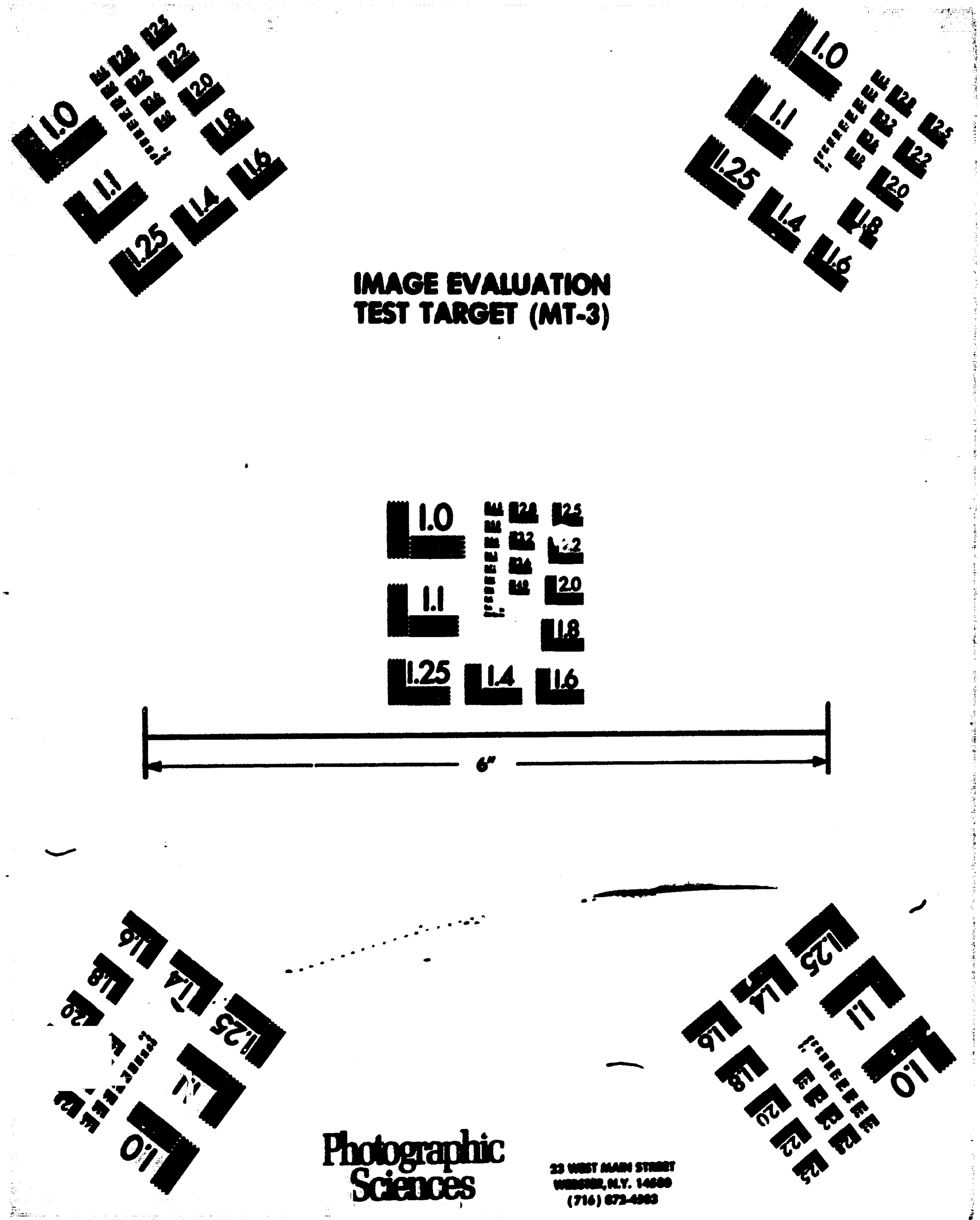
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JPRS L/8370

3 April 1979

USSR

TRANSLATIONS ON USSR RESOURCES
(FOUO 7/79)

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TRANSLATIONS ON USSR RESOURCES

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ELECTRIC POWER AND POWER EQUIPMENT

FOURTH YEAR OF THE FIVE-YEAR PLAN: PROBLEMS, TASKS

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 79 pp 2-3

[Article by A. K. Antonov, USSR Minister of the Electrical Equipment Industry: "Fourth Year of the Five-Year Plan — Problems and Tasks of the Sector"]

[Text] For workers of the electrical equipment industry, just as for all the working people of the country, last year, 1978, was a year of fruitful struggle to fulfill the assignments of the 10th Five-Year Plan. During this year workers of the sector by heroic labor made a significant contribution to progress in the energy system, metallurgy, and the petroleum, gas, and mining industries, to solving the problems of full automation and mechanization of agriculture, technical re-equipping of transportation, and raising the level of electrification in everyday life. The annual plan and socialist obligations were fulfilled for the principal technical-economic indexes.

The work of the sector to supply modern machinery and equipment to all spheres of the national economy will continue in 1979. The concrete guidelines for this work are the decisions of the 25th party congress and subsequent Plenums of the CPSU Central Committee and the statements and conclusions contained in the reports at them by General Secretary of the CPSU Central Committee and Chairman of the Presidium of the USSR Supreme Soviet L. I. Brezhnev and in his talks during his trips to Siberia and the Far East, Minsk, and Baku. The 1979 plan also includes very important assignments given to the electrical equipment industry by the CPSU Central Committee and USSR Council of Ministers decree entitled "Further Development of Machine Building in 1978-1980," which was adopted in September 1978 and illustrates once again the enormous attention that the party and government give to the development of electrical equipment as one of the key economic sectors.

In the fourth year of the five-year plan, as in the preceding years, all economic managers should focus their attention on questions of timely supply of modern electrical equipment to the most important construction sites of the national economy, primarily those in Siberia, the Far North, and the Far East. The Elektrosila, Uralelektrotyazhmash, and Elektroapparat production associations, the Khar'kov Electrical

Machine and Lys'va Turbogenerator plants, and many other associations and enterprises of our sector are performing an enormous volume of deliveries for the Sayano-Shushenskaya GES, the West Siberian Metallurgical Plant, the Kemerovo Azot Association, and other national economic installations located in the eastern part of the country. The rate of increase in the extraction of coal, petroleum, and gas and development of the aluminum, petrochemical, and mining industries, all the sectors that ultimately determine the economic might of our country, depend largely on how well our sector performs planned deliveries and contract obligations.

The fourth year of the five-year plan should be marked by the sector's making a significant new contribution to further bolstering the material-technical base of agriculture. The decisions of the July 1978 Plenum of the CPSU Central Committee obliged workers of the electrical equipment industry to give priority to everything related to building and incorporating highly reliable electrical equipment for the countryside. In 1979 not only is the production of electrical equipment for agricultural needs to increase 10 percent, but the qualitative composition of this equipment is expected to change fundamentally. This refers to a sharp increase in the production of special agricultural models of electrical equipment, in particular series 4A electric motors with built-in temperature protection, low-voltage units, and other articles and assemblies that work reliably in the specific and very complex conditions of an aggressive environment with heightened dust and humidity in the air. All necessary electrical equipment for construction projects to produce mineral fertilizers, among which is the Novgorod Azot Association among others, is to be delivered in the first six months.

The party and government have given the electrical equipment industry the additional and very important tasks of increasing the production of industrial and mainline electrical locomotives and electrical equipment for mine dumptrucks and large-capacity truck trains. Increasing the production of consumer goods and improving their quality, consumer features, and external appearance remain one of the sector's paramount challenges.

The plan for 1979 envisions continued growth in the volume of production of electrical equipment, labor productivity, and profit. Especially high rates of production are envisioned for certain types of output: large electrical machines — 11 percent; special production equipment for the electrical equipment industry — 29 percent; thyristor transformers — 23 percent; series 4A electric motors of sizes 7-9 — 13 percent; electrical heating equipment — 8 percent; consumer goods — 7 percent.

Alongside growth in the volume of industrial production a consistent policy of improving quality, the technical level of electrical equipment, and its economic efficiency will be pursued. Workers of the sector face a challenge of enormous importance to the state: before the end of the five-year plan build and incorporate new, highly reliable electrical equipment whose service life and productivity will be 1.5-2 times greater than the 1975 level with a significant improvement in technical-economic indexes. A significant part of this work must be done in 1979: it will be essential to incorporate more than 1,500 new articles and assemblies and take more than 550 obsolete types of equipment out of production. Plans call for the percentage of output with the State Mark of Quality to reach 42 percent, 2.5 times greater than planned for 1978.

Considering the national economy's enormous and steadily growing demand for absolutely all types of electrical equipment and understanding their lasting significance for intensification of public production, workers of the sector must do everything possible to relieve the strain in supplying the economy with such articles as large electrical machines, high-voltage equipment, electric furnaces, cable and wire (especially winding wire), galvanic elements, and the like. This means that they should focus on all factors involved in raising efficiency and work quality and not only fulfill, but overfulfill the plan assignments and socialist obligations of the fourth year of the five-year plan. This is a difficult challenge, but it can be done if we skillfully concentrate our attention on solving the key problems of the present day: growth in labor productivity, economy measures, and putting scientific-technical advances to use.

Among the crucial reserves for raising labor productivity in our sector are maximum use of existing production capacities, faster incorporation of new capacities, technical re-equipping of enterprises, and (related to this) efficient use of capital investment.

In 1979 plans call for using existing production capacities in most specialized types of electrical equipment at 95-100 percent. The shift coefficient is to be raised to an average of 1.69 for the sector. But despite these high indexes, the volume of production of many types of electrical equipment will still be inadequate to meet national economic needs. Therefore, today when the party is forcefully restating the challenge of raising standards in all sectors, the question of the responsibility of all-Union industrial associations and enterprise and organization managers for unconditional fulfillment of capital construction plans and timely introduction of new production capacities into operation becomes more critical than ever. This applies above all to all-Union industrial associations such as Soyuzelektroistochnik, Soyuztransformator, Soyuzelektromash, and Soyuzelektrotyazhmash.

The bulk (about 70 percent) of capital investment this year is to be concentrated at priority construction sites, while the remainder will go for technical re-equipping of enterprises. It is very important that efficient use of capital investment become a daily concern of all economic, party, and trade union leaders at enterprices and organizations of the sector. This is one of the key problems today.

The all-Union production associations should also devote special attention to refining capital construction plans to improve the balance of production capacities. It is no secret that, because of an ill-considered approach to this problem in the sector, we still have a critical shortage of production capacities to produce articles used in various sectors, and this ultimately retards the production of very important items, specifically electrical equipment for electrical and diesel locomotives, large electric machines, and the like. In this connection economic managers must give special attention to Comrade L. I. Brezhnev's statement in Baku concerning more exact consideration of local and national interests and bringing them into line and more actively mobilizing local resources to solve major national problems.

The party emphasizes again and again the need for thrifty use of material resources and observation of the strictest economies with respect to metal, fuel, and energy. Whether it is a question of series production of output or the development of new technology, we must remember that one of the main qualitative indexes of all work in the sector is reducing the metal-intensiveness of output. It is particularly important here to make skillful use of scientific-technical advances, including raising unit capacities and voltages of electrical equipment, introducing progressive new technology and the technique of functional-cost analysis, standardization of parts and assemblies, and the like. And this is not all.

Practice teaches us that the best results come from close cooperation between production, scientific research, and planning-design collectives, on the one hand, and users of our products on the other. It is no longer enough to know the consumer's needs and fulfill contract obligations on time; it is important to teach the consumer to select and use electrical equipment intelligently. Unfortunately, there are still many cases where electrical equipment is used without considering operating conditions and often machines with unjustifiably large parameters (power, voltage, heat-resistance, and the like) are used. Straightening out this matter would be equivalent to producing an additional, large amount of expensive and often scarce equipment.

The initiative of NIPTIEM [Scientific Research, Planning-Design, and Technological Institute of Electrical Machine Building] deserves attention here. This institute, after analyzing the use of electric motors in different spheres of the national economy, worked out recommendations on correct selection and operation of these machines. At the same time they established a rigorous procedure under which a customer can only receive his order in accordance with the recommendations. This innovation had a significant impact: more than one million rubles was saved in one year. All subsectors of the electrical equipment industry should adopt this practice of NIPTIEM.

Speaking at the ceremonial meeting in honor of the 61st anniversary of the Great October Socialist Revolution, Comrade A. N. Kosygin emphasized that the paramount challenge is to mobilize all forces to fulfill the five-year plan and socialist obligations in the collectives of all enterprises and associations. Plan assignments should be fulfilled for total production volumes, for established assortment, and for delivery times. As always, socialist competition has an enormous role to play.

At the end of the third year of the five-year plan the names of the leaders in socialist competition become known. They were awarded 1978 State Prizes for outstanding labor achievements. Among them were L. F. Zaytseva, leader of a brigade of assembly workers at the Miasselektroapparat [Miass Electrical Equipment] plant and A. V. Chokoy and Ye. V. Budishtyan, employees of the Moldavkabel' [Moldavian Cable] Plant in Bendery. Thousands of leaders of industry completed their personal five-year plans and plans for the first four years of the five-year plan. The workers of the Elektrosila Association are setting an example. They completed delivery of a 640-megawatt hydrogenerator for the Sayano-Shushenskaya GES ahead of schedule and also delivered primary equipment for the main unit of the second phase of the Ust'-Ilimskaya GES. The collective of the Baku Domestic Air Conditioner Plant produced tens of thousands of units beyond the plan. The experience of these and other outstanding collectives in this five-year plan must be studied and disseminated by every means.

For workers of the sector, just as for all Soviet people, the fourth year of the five-year plan is a year of preparation to celebrate the 110th anniversary of the birth of Vladimir Il'ich Lenin. The movement to work out and propose stepped-up counterplans must become widespread from the first days of the new year. Everyone knows that the party attaches great importance to counterplans, which organically combine centralized management of the national economy and the creative initiative of the working people. It is important to see that qualitative indexes such as stepping up growth in labor productivity, raising the quality of output, lowering its prime cost, and saving raw materials, energy, fuel, and metal are centers of attention. We must create favorable conditions for accomplishing counterplans in every labor collective.

The search for reserves assumes thorough study, generalization, and dissemination of progressive know-how. We are speaking of widespread introduction of progressive labor methods, improved organization of production and management, and scientific-technical advances. 1979 must be a year of even more energetic creative introduction of the Dinamo method of raising labor productivity on the basis of personal plans, the practice of continuous production planning adopted by the Novocherkassk electrical locomotive builders, the experience in campaigning for equality accumulated by the Elektrosila workers and the collectives of the Azerelektrosvet [Azerbaijan Electrical Light] Association, the Plant imeni Vladimir Il'ich, and other enterprises, the procedures of the Saransk Elektrovypryamitel' Plant to involve working people in production management, and various other progressive forms of work that have demonstrated high effectiveness not only in our sector, but also in other sectors of machine building. All party, Soviet, and economic employees and trade union and Komsomol leaders must direct their attention to these matters.

There is no doubt that the workers of the electrical equipment industry will work their hardest to fulfill the state plan and stepped-up socialist obligations of 1979 and thus lay the foundation for successful conclusion of the five-year plan as a whole.

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CSO: 1822

ELECTRIC POWER AND POWER EQUIPMENT

ORGANIZATIONAL MOVES PLANNED TO FACILITATE INTRODUCTION OF NEW EQUIPMENT

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 1, Jan 79 p 72

[Article by P. P. Falaleyev, first deputy USSR minister of power and electrification: "Introduction of New Technology in the USSR Ministry of Power and Electrification"]

[Text] Raising the work efficiency of scientific research and planning-design organizations is one of the key challenges posed by the 25th CPSU Congress. Achieving optimal results from labor is inconceivable without accelerating the process of building new equipment and introducing it in construction and industry quickly.

In connection with this, there is no question that the discussion of a broad range of issues in the journal ENERGETICHESKOYE STROITEL'STVO is timely. This refers to the articles "Introduction of New Equipment — the Way to Raise the Efficiency of Energy Construction" by G. A. Denisov, Ye. A. Gel'man, and Ya. F. Sokolov (No 9, 1978), "Deciding Questions of Introducing New Equipment" by Yu. A. Gabilya, A. B. Rubinshteyn, I. A. Kirtbaya, E. Ya. Ovcharov, V. V. Yeremenko, L. G. Nikolaichev, and L. A. Kostrov (No 10, 1978), "Organizational Problems of Making and Incorporating New Equipment" by K. I. Chikvaidze (No 11, 1978), "Development and Introduction of New Technical Concepts at the Elektrostroypodstantsii Trust" by A. I. Brenner, T. S. Burukhina, and A. I. Khokhlov (No 12, 1978), and "Promising Areas in the Development and Introduction of New Equipment" by G. I. Iyevlev in the present issue.

The most important task of energy construction workers and the employees of scientific research and planning-design organizations is to continue refining the organizational systems for building and introducing new equipment for the purpose of significantly raising labor productivity in energy construction, reducing the number of employees, and improving other qualitative indexes.

At one time the Orgenergostroy [Organization of Energy Construction] Institute was named head organization for solving general problems of the development of energy construction and issues of the economics, industrialization, and full mechanization and automation of construction and installation work, development of the base of the construction industry, and raising labor productivity.

The number of organizations studying research questions and engaged in experimental design work in energy construction has now grown and leading institutes specializing in particular questions have emerged. They are Atomenergostroyproyekt [State Institute for the Planning of Atomic Energy Construction], Energomontazhproyekt [State Planning Institute for Energy Installation Work], and the scientific research subdivisions of the planning institutes.

The problem now is to increase the working efficiency of each institute, prevent parallel work, and achieve proper coordination. This should be accomplished through the Main Production-Technical Administration for Construction and Glavniiproyekt [Main Administration of Scientific Research and Planning Organizations]. Very little is being done in this area at present, so many useful developments by our institutes are not finding application and remain merely paper.

Other timely problems are studying and disseminating the useful know-how of other ministries and departments and formulating new normative documents to regulate the work of scientific research institutes, design bureaus, and plants in development and manufacture of new equipment, introduction of it in construction and industry, and elimination of shortcomings.

Needless to say, the primary thrust continues to be raising the quality of scientific research and experimental design development simultaneously with a reduction in expenditures on it. It would be advisable to join the efforts of scientific research organizations to solve the largest problems. In some cases special design subdivisions could be formed according to the list of experimental models of new equipment in design and manufacturing, and manufacturing plants could be assigned to them.

Of course, before series production of models of new equipment there must be multifaceted testing at special testing sites and under production conditions. For this reason it is essential to review the question of forming specialized organizations (testing grounds) within the USSR Ministry of Power and Electrification similar to machine testing stations and to set up experimental construction-installation organizations that perform construction work using progressive technology and new equipment.

Thus, further improvement in work to build and introduce new equipment as quickly as possible with a reduction in labor inputs depends largely on organizing a single integrated system of scientific research and experimental design work.

The USSR Ministry of Power and Electrification recommends the following:

GPTU [Main Production-Technical Administration for Construction] and Glavniiproyekt, in order to eliminate duplication and parallelism in work, should prepare proposals in 1979 to ratify head organizations for new equipment in energy construction according to primary types of general construction jobs and basic areas of work based on the specialization of institutes and the jobs performed by them. They should develop and ratify a statute on the planning of scientific research and experimental design work in energy construction which defines and regulates the procedures for development, ratification, and correction of plans and financing of scientific research and experimental design projects, evaluates the work of institutes, and so on. Each year they should publish an order on the plan for development and introduction of new equipment following the practices of the Ministry of Installation and Special Construction Work.

Glavniiproyekt, GPTU, the Main Planning-Economics Administration, and the Financial Administration should prepare steps to insure coordination of capital allocated for building new equipment by all sources of financing and labor ceilings.

In the first half of 1979 Glavenergostroymekhanizatsiya [possibly Main Administration for Mechanization of Energy Construction] and GPTU should prepare proposals on setting up within the USSR Ministry of Power and Electrification System a large experimental plant for the manufacture of experimental test models of new equipment and production of pilot series, providing this plant with a test site and central machine testing station.

Glavenergostroymekhanizatsiya should, within the same time, prepare proposals for the establishment of a special service at the planning and design bureau of Glavenergostroymekhanizatsiya to work on questions of reliability in building and testing new equipment.

Glavsnab [Main Administration of Supply], Glavenergokomplekt [Main Administration for Coordination of Assembly Components], and Glavenergostroymekhanizatsiya should review the question of centralized allocation of materials, assembly components, and base machines from USSR Ministry of Power and Electrification resources and submit proposals on this issue.

Either directly or through the head organizations of the USSR Ministry of Power and Electrification Informenergo [possibly Energy Information Service] should establish long-term ties with the information services of the ministries of Construction of Petroleum and Gas Industry Enterprises, Heavy and Transport Machine Building, Transport Construction, Installation, and Special Construction Work, and Construction and with the information center of the Academy of Sciences. At least once a year it should cover the most efficient achievements of these ministries in the field of special and general construction work in a series of information bulletins.

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ELECTRIC POWER AND POWER EQUIPMENT

NEW TECHNOLOGY IN POWER CONSTRUCTION DEVELOPED, MORE PLANNED

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 1, Jan 79 pp 69-71

[Article by G. I. Iyevlev, engineer: "Promising Areas in the Development and Introduction of New Equipment"]

[Text] The decisions of the 25th CPSU Congress consider acceleration of scientific-technical progress one of our paramount challenges. The primary directions of scientific work are raising efficiency, strengthening ties with production, accelerating the introduction of progressive new concepts, and concentrating personnel and resources on the most pressing issues.

Raising the technical level of construction work is one of the basic factors in the USSR Ministry of Power and Electrification's five-year plan for raising labor productivity. The development, building, and introduction of new equipment is a sphere of activity for scientists, designers, and production workers. The ministry is allocating significant capital for this purpose and doing major work in this area.

Energy construction workers have made significant advances in continuing industrialization, the use of progressive materials and designs, refining technology, expanding the mechanization of production processes, and building automated control systems. Planning and construction organizations of the ministry are successfully carrying out plans for construction of installations from large-sized elements, assemblies, and modules with complete prefabrication of carrying and separating pieces, large-panel modular housing construction, erection of large-panel cultural-domestic buildings, installing technological equipment in large blocks, using factory-ready slabs for the facing of buildings and structures, and so on.

Assignments are being fulfilled for the manufacture of prefabricated prestressed reinforced concrete elements and pieces and triple-layered separating pieces made of shaped sheet steel and for use of shaped glass, cold-bent shapes, increased strength steels of grades S-46/33 and S-52/40 (for manufacturing steel design elements), concretes of grades 500 and higher (for manufacturing reinforced concrete elements), and progressive kinds of piles (prestressed, drilling-driving, pyramidal, rhomboidal, timber, and others).

Organizations of the USSR Ministry of Power and Electrification are introducing progressive construction and installation technology on a broad scale. Special mention should be made of such projects as building prestressed protective shells for water-moderated water-cooled power reactors, cementing underground hydroengineering structures with a poured concrete mixture, installing steel bolt-type intermediate towers preassembled in sections for 500 and 750 kilowatt transmission lines, laying unchanneled heat line piping with bitumen-perlite insulation applied at the factory, unheated installation of transformers using Sukhovey and Iney devices, preinstallation inspection and debugging of equipment, installing reinforced concrete wall and ceiling cells, hydroinsulation of underground design elements with polyethylene, and others.

Scientific research and planning-design organizations of the USSR Ministry of Power and Electrification, cooperating with plants and construction-installation organizations of the sector, have designed, built, and are successfully introducing many new machines, mechanisms, and mechanized tools.

About 220 descriptions of machines, mechanisms, and pieces of equipment have been put in series production in industry as the result of development projects carried out according to the new equipment plan alone. Large-capacity construction and installation cranes have been put into production, specifically the KBGS-1000, which can lay concrete in tubs with eight cubic meters capacity, and the SKR-2200em installation cranes.

Special mechanisms have been built for the construction and installation of power transmission lines: the KVL-8 tower installer (towers up to 26 m high) and a line carrier designed on the basis of a KrAZ-255 truck. Technology has been devised and is being introduced for concrete jobs, making it possible to significantly increase labor productivity in this primary type of work: the BSU-750 fast-installation modular cement mixer; modernized tubs with capacities of 2,4 and eight cubic meters; a series of new types of deep vibrators and manipulator cranes; an electrical all-terrain vehicle with ribbed tires to mechanize concrete laying jobs in the construction of concrete dams. Production of mobile stations for finishing and plastering work and traveling workshops and laboratories is also planned. However, it must be noted that the plants of Glavenergomekhanizatsiya [possibly Main Administration for Mechanization of Construction] is moving slowly to incorporate series production of new mechanisms to perform construction and installation jobs, and as a result many unrealized technical documents related to new equipment are piling up at planning and design organizations.

Considerable attention is being devoted to building automated control systems. Among the systems now introduced are the KROSS automated information system which solves such problem sets as monitoring and analyzing progress in construction and installation at priority sites of the USSR Ministry of Power and Electrification; the automated system for monitoring execution of organizational-executive documents (ASKD) of the USSR Ministry of Power and Electrification; an automated control system for the production and delivery of reinforced concrete design elements to construction sites (ASU-Zhelezobeton), which is a set of automated systems covering the structure plant — trust — main administration (Glavenergostroyprom [possibly Main Administration of Industrialization of Construction of the USSR Ministry of Power and Electrification]) with respect to deliveries, loading, and material-technical support for production of prefabricated reinforced concrete.

Calculations show that the average impact of one ruble of expenditures for introduction of development projects from our scientific research and planning organizations is 4-5 rubles. Because a significant share of the development work being done does not, for various reasons, reach the stage of incorporation in production, there is reason to believe that we have substantial reserves for raising labor productivity and reducing the cost of energy construction that can be realized by organizing rapid introduction of all effective development ideas.

One of the prime ways to sharply increase labor productivity in energy construction is to reduce the level of manual labor. At the present time it constitutes 41.2 percent of primary construction and installation work and auxiliary jobs; in concrete, carpenter and cabinet, and plastering work the level of manual labor is 44.6, 73.7, and 62.7 percent respectively. Such a level of manual labor in these jobs greatly exceeds the average index in energy construction.

The primary reasons for the high proportion of manual work are the following:

a. poor installation technology in particular planning and design decisions (unsatisfactory design of connections and inadequate standardization of construction and auxiliary elements such as stairways, doors, gates, and the like);

b. violation of planning technology in the overall order of work, resulting in unnecessary formation of crowded and inaccessible places with no mechanized equipment available to work under such conditions;

c. absence of compulsory rules and diagrams for the performance of certain frequently repeated construction and installation processes;

d. insufficient quality of factory-ready construction elements (builders are forced to fix them up right at the site, usually by hand);

e. subpar performance of construction and installation job which leads, of course, to redoing and fixing up defects;

f. insufficient assortment of mechanized equipment for small jobs;

g. lack of progressive, tested technological plans for full, integrated mechanization or automation of the entire technological process for many basic labor-intensive types of construction and installation work, and failure of industry to incorporate series production of the set of machines and mechanisms needed for integrated mechanization.

Eliminating these causes of the still-existing high level of manual labor in construction of energy facilities should be the primary objective in planning and carrying out programs for the introduction and incorporation of new equipment.

The system of development, building, and introducing new technology that now exists in the USSR Ministry of Power and Electrification has serious shortcomings, including the following:

a. imperfections in the planning and coordination of scientific research and planning-design work;

b. lack of permanent, clearly organized ties among scientific research organizations, planning-design organizations, and the industrial enterprises that manufacture the articles;

c. lack of precise planning for manufacturing and assembling the parts of new machinery being developed by noncentralized sources;

d. inadequately organized economic analysis of the introduction of new technology and mechanized equipment, lack of an organized system of selecting scientific information according to the most effective developments performed by organizations of other ministries and departments;

e. lack of solutions to the questions of considering specific labor limitations on the organizations that develop and manufacture new equipment.

The Main Production-Technical Administration for Construction has prepared a draft order entitled "Systematizing the Planning, Manufacture, and Introduction of New Equipment and Raising the Use Efficiency of Centralized Capital to Incorporate this Equipment in Capital Construction and Industrial Activity." This order sets out steps to systematize the questions reviewed above.

The current level of economic development of all national economic sectors determines the corresponding energy base and, therefore, the primary lines of development of the country's electrical power system: accelerated construction of atomic power plants in the European SSR; construction of large fuel-energy complexes in the eastern regions of the country using coal from the Ekibastuz and Kansk-Achinsk deposits; building the large series of hydroelectric power plants on the Angara and Yenisey; constructing superhigh voltage AC and DC power transmission lines.

To successfully meet these challenges the ministry must carry out a significant volume of construction and installation. By 1990 the volume of this work will double compared to the 10th Five-Year Plan. Accomplishing such tasks necessitates raising the machine-worker ratio by almost four times and the power-worker ratio three times, increasing the degree of prefabrication of construction elements to 90 percent, reducing the proportion of manual labor to 30 percent, and almost doubling labor productivity. All this makes a significant increase in the volume and rise in the efficiency and quality of planning, scientific research, and experimental design work urgent.

We should also consider the most promising areas in development and introduction of new equipment to facilitate solutions to the primary problems of insuring introduction of planned capacities and raising the efficiency of capital investment in energy construction.

Construction of Thermal and Atomic Power Plants

1. Further refinement of the technology of large-module installation of construction elements and production equipment at thermal power plants using installation modules with a high degree of factory readiness.

2. Simplification of "zero cycle" (subsurface) design elements with some utility hookups placed above this marker.

3. Development and introduction of standardized high-turnover fast-installation framing.

4. Designing and introducing fully prefabricated heat insulation designs.

5. Development of new roofing technologies that have minimal labor inputs.

6. Improving designs and technology for installation and pouring cement of fitting and framing modules in construction of reactor compartments and special wings of atomic power plants.

7. Full mechanization of finishing work in the special rooms of atomic power plants with development of new radiation-resistant covering materials.

Construction of Hydroelectric Power Plants

1. Development and introduction of high-speed flow construction of rock-fill and concrete dams using continuous transport; using combines to cut and cement hydroengineering tunnels.

2. Full mechanization of the construction of reinforced concrete penstocks instead of metal ones.

Construction of Transmission Lines and Substations

1. Further refinement of design concepts for modular-built substations to reduce construction times, use of materials, and labor inputs.

2. Building and introducing new types of means of transportation and installation equipment for construction of high-voltage overhead lines in inaccessible regions of Siberia and the Far East, including helicopters and dirigibles.

3. Introduction of new mechanized ways to secure power line towers in the ground with no manual labor at all.

4. Development and introduction of quick-installation mobile consolidated assembly points for power line towers on the construction route.

Construction of Temporary Construction Bases at the Construction Sites of Power Plants and Large Substations

1. Further refinement and broad introduction of designs and factory technology for manufacturing quick-installation standardized buildings to house the full complement of basic materials and equipment for the construction organization and subcontractors in order to significantly reduce the preparatory period with minimum labor inputs.

2. Introduction of quick-installation modular concrete plants and gravel sorting systems.

It should be emphasized that setting up a single integrated system of scientific research and experimental design work in the USSR Ministry of Power and Electrification will make it possible to define promising areas of development based on thorough analysis of the existing technical level of development of the sector and all-encompassing and reliable information on domestic and foreign achievements. It will guarantee precise coordination of work and unified planning in all stages, from the beginning of scientific research work to introduction into production of new equipment, machines and mechanisms, small power tools, design elements, materials, production lines, and the like.

First of all certain specific planning, scientific research, and design-technological organizations must be identified as head organizations to coordinate particular types of construction or particular types of common construction jobs: electrical grid construction, construction of tall structures such as chimneys and cooling towers, earthwork and special jobs in building structures at zero level, and concrete, finishing, and other work. When naming head organizations special attention must be given to whether they have highly qualified specialists in the particular sector and how effective development projects already performed by these organizations in the particular area have been.

A correctly and clearly organized scientific-technical information service is expected to play a large part. One of the fields of activity of the information service, already mentioned above, is providing timely information on advances in other economic sectors and at academy institutes.

It seems advisable to review the question of annual publication of a single directive document (in the form of an order, plan, or something similar, which would have to include assignments envisioning the following:

a. introduction of progressive production technology;

b. development, testing, and production of the first industrial series of new machines, equipment, attachments, and tools;

c. introduction of flow mechanized and technological lines at plants and enterprises of the USSR Ministry of Power and Electrification;

d. development, testing, and manufacture of the first industrial series of efficient new materials, design elements, and parts;

e. determination of the most important scientific research, experimental, and planning-design topics;

f. establishment of automated control systems;

g. use of computer technology at ministry organizations.

Preliminary calculations must be made for all assignments with respect to economic impact and possible reduction of labor input as well as the approximate amount of the bonus or new equipment. Full expenditures for development must be taken into account along with the economic efficiency achieved when determining the actual size of the bonus for new equipment.

In addition, the USSR Ministry of Power and Electrification should set up a service that studies questions of the reliability of new models of equipment being developed and produced. It would be advisable to establish this service in Glavenergostroymekhanizatsiya. One of the primary jobs of this service should be to increase the motor capacity of new models of equipment being designed. To do this it is necessary to work out recommendations for design organizations and manufacturing plants and to establish the assortment and periodicity of deliveries of special spare parts for series models of new equipment in the first 3-5 years of use.

To achieve further improvements in the research — introduction cycle plans call for the Main Production-Technical Administration for Construction and the Orgenergostroy Institute to develop in 1979 a draft statute on the planning, manufacture, and introduction of new equipment in the system of the USSR Ministry of Power and Electrification. In this document all elements of the comprehensive system should be put in concrete form to guide the work of organizations and enterprises to building new equipment as quickly as possible with minimum inputs of labor and material-technical resources.

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ELECTRIC POWER AND POWER EQUIPMENT

ENERGY SYSTEM DEVELOPMENT, PLANS REVIEWED

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 12, Dec 78 pp 2-4

[Article: "Energy Workers Day"]

[Text] Each year on 22 December the Soviet people celebrate Energy Workers Day. This traditional holiday of Soviet energy workers and builders was established in honor of Lenin's plan for electrification of Russia, which was adopted at the 8th All-Russian Congress of Soviets. The glorious history of Soviet power workers begins on this same date.

Thanks to the constant attention and concern of the Communist Party and Soviet Government our energy industry has become a leading sector of socialist industry with a significant influence on contemporary scientific-technical progress. As a result of consistent implementation of a policy of accelerated growth in progressive sectors of the fuel and power industry, our country quickly became one of the world leaders in extraction of fuel and production of electrical energy. Electricity production in the country passed one trillion kilowatt-hours in 1975. This is 2,000 times more than was produced by all t' power plants of Russia in 1920, when the GOELRO [State Plan for the Electrification of Russia] was adopted.

The Directives of the 25th Congress of the Communist Party stipulated continued development of the energy industry and electrification of the country. During the 10th Five-Year Plan about 70 million kilowatts of new energy capacities will be launched, including more than 13 million kilowatts at atomic power plants. By the end of the five-year plan the total capacity of Soviet power plants will be about 280 million kilowatts and production of electrical energy will reach 1,340-1,380 billion kilowatt-hours.

The proudest features of the Soviet energy system are the Krasnoyarskaya Hydroelectric Power Plant with a capacity of 6 million kilowatts, the Bratskaya Hydroelectric Plant with a capacity of 4.1 million kilowatts, the Ust'-Ilimskaya Hydroelectric Plant with a capacity of 3.6 million kilowatts, the Leningrad Atomic Power Plant with two reactors that have capacities of 1 million kilowatts apiece, and the largest thermal power plant, the Krivorozhskaya GRES-2 with a capacity of 3 million kilowatts. Sixty-seven thermal power plants have capacities of more than 1 million kilowatts; 27 of them have more than 2 million kilowatts.

Transmission lines with voltages of 220-750 kilovolts have joined the power plants of the European SSR, Urals, Western Siberia, and Northern Kazakhstan into the Unified Power System. Large-scale power associations have been formed in Siberia, the republics of Central Asia and Southern Kazakhstan, and the Far East. The program adopted by the party for integrated development of the natural wealth and productive forces of Siberia and the Far East is exceptionally important for further development of the country's fuel-energy base.

Electrification of the sectors of industry, transportation, municipal services, and agriculture has proceeded at a high rate based on the development of electrical energy. This made it possible in a short time to revise their technical bases, intensify production processes, introduce mechanization and automation of technological processes on a broad scale, and ultimately raise labor productivity and improve working and living conditions for the population.

Industry and construction are the largest consumers of electricity (65 percent of total consumption in the country). It will be necessary to use at least 750 billion kilowatt-hours of electricity in 1980 to accomplish the tasks facing industry in the 10th Five-Year Plan. This figure includes 230 billion kilowatt-hours for the needs of electrical technology. The power-worker ratio in industry will increase 26 percent during these five years.

Major advances have been made in the electrification of agricultural production. In the time since the March 1965 Plenum of the CPSU Central Committee, which marked a new stage in development of the party's Leninist agrarian policy, much has been done to re-equip agriculture on the basis of electrification. More than 2.5 million kilometers of power lines have been built; the total length is more than 3.7 million kilometers. In addition, we have built transformer substations with a total capacity of more than 140 kilovolt-amperes. The number of electric motors at kolkhozes and sovkhozes is 4.8 times greater than it was in 1965, and the number of electrical installations in production processes has increased seven times. In 1977 agriculture used about 90 billion kilowatt-hours, 4.2 times more than in 1965. The power-worker ratio at kolkhozes and sovkhozes has risen 5.6 times, while the consumption of electricity for municipal and domestic needs has increased 3.5 times. The July 1978 Plenum of the CPSU Central Committee outlined a broad program for further development of agricultural production by a planned transition to an industrial basis.

The party and government, devoting significant attention to questions of the development of the power industry and electrification in our country, are equally interested in the problems of economical expenditure and increasing the use efficiency of fuel-energy resources. The problem of conserving public wealth and striving for rational use of raw and processed materials, fuel, and electricity is posed as one of the chief problems of socialist management in the decisions of the December 1977 Plenum of the CPSU Central Committee and in the Letter of the CPSU Central Committee, USSR Council of Ministers, AUCCTU, and central committee of the Leninist Komsomol entitled "Organization of Socialist Competition for Fulfillment of the 1978 Plan and Intensifying the Campaign to Raise Production Efficiency and Work Quality."

This challenge is becoming crucial for the national economy because of the increase in material, labor, and financial expenditures for the development of the country's fuel-energy base in light of the territorial shift of fuel extraction sites to the east. Moreover, the cost of taking steps to save fuel and energy is less than the cost of producing them and technological developments that aim at energy savings may be put into production practice more rapidly than technology to produce an equivalent amount of energy. Energy savings is also preferable to additional production from the standpoint of environemntal influences.

The 10th Five-Year Plan calls on energy workers in industry, construction, and transportation to cut electricity consumption by 50 billion kilowatt-hours or five percent compared to 1975 norms. To accomplish this enterprises are developing and implementing more than 2,500 steps to save electrical and thermal energy each year. As a result of the socialist competition for economy and thrift, all collectives at industrial, construction, and transportation enterprises have assumed stepped-up obligations with respect to saving fuel, electricity, and thermal energy. In the first two years of the five-year plan 7.7 million tons of standard fuel was saved at our power plants by reducing the specific expenditure of fuel per kilowatt-hour delivered from 340 to 334.4 grams. In this the enterprises of industry, construction, and transportation saved 25 billion kilowatt-hours of electricity and 47 million gigacalories of thermal energy; in the first six months of 1978 their savings were 7.2 billion kilowatt-hours and 13.9 million gigacalories.

The March decree of the CPSU Central Committee concerning the organizational and political work of the Kemerovskaya Oblast CPSU Committee to save fuel and energy resources at enterprises and construction sites of the oblast is a broad program for continued work to save energy resources. Special attention is given to developing the creative initiative and activism of production collectives and all working people, to determinedly removing the shortcomings that are retarding dissemination of progressive know-how in using internal reserves, improving equipment and technology, raising the quality of output, and reducing its energy-intensiveness.

The struggle of the working people for thrift and economy became truly national in scope during the third year of the five-year plan, and energy workers are the pioneers and organizers of saving energy resources. This work takes many forms. There are commissions and headquarters for rational use of energy resources at virtually every industrial enterprise. More than 20,000 enterprises in all the republics, krays, and oblasts are participating in socialist competition among industrial enterprises for the best electricity savings indexes. Public inspections, contests, and competition among shops, sections, and works for saving energy resources are organized at the enterprises. Each year there is an all-Union contest for best proposals to save electricity and thermal energy. Similar contests are held in 80 krays and oblasts. Working people include energy savings indexes in their personal creative plans, socialist obligations, and personal five-year plan records (accounts). Figures on savings of fuel and energy resources are considered equally with the primary indexes of the production and economic activities of enterprises when summarizing the results of socialist competition among industrial enterprises. People's control workers regularly make surprise visits to uncover mismanagement and waste in the use of energy resources. Questions of energy savings are treated extensively by all mass propaganda and information media. Study of progressive know-how in saving energy resources is studied in the system of economic education and raising worker qualifications and in schools of communist labor at many enterprises.

Many of our country's industrial enterprises have accumulated valuable experience in work on energy savings. This work is based on future and current planning of energy savings activities and implementing them. The collective of the Magnitogorsk Metallurgical Combine imeni V. I. Lenin worked out a plan of 476 steps to save electricity and thermal energy in 1978. Carrying out this plan will enable them to save 166 million kilowatt-hours of electricity and 351,000 gigacalories of thermal energy. Thus the combine will meet established norms for energy expenditure and fulfill its assignment for an additional savings of at least three percent. In addition to introducing technical measures, a great deal of organizational work is being done at the combine to mobilize the collective to identify and use additional reserves for energy saving. Large-scale public inspections of efficient use of fuel and energy resources are held each year.

The collectives of the enterprises of the Ural'sk Turbine Motor Plant, the Perm' Permnefteorgsintez Production Association imeni XXIII S'yezda KPSS, the Volga Motor Vehicle Plant, the Zhdanov Tyazhmash Production Association, and many others have made significant advances in economical use of energy resources.

Nonetheless, we are far from using all reserves for saving fuel and energy resources today and cases of mismanagement and waste occur at many enterprises. Each year more than 1,000 enterprises permit specific expenditure of electricity and thermal energy to exceed established norms. A survey made by agencies of the state energy supervisory board in 1978 at 2,175 enterprises found cases of irrational use totaling 905 million kilowatt-hours of electricity and 4.7 million gigacalories of thermal energy. Existing reserves for energy savings are also estimated to be large. It is a very important duty of energy workers in all economic sectors to bring them into play quickly and preclude any mismanagement and waste in the use of fuel, electricity, thermal energy, and other energy carriers.

Continued technical improvement in the energy systems of enterprises and use efficiency of energy resources will be pursued in the following areas:

1. refining energy supply schemes to increase their reliability and economy; development of integrated future plans for development of the energy base of each enterprise;

2. widespread introduction of dispatching and remote control based on modern means of communication in enterprise power systems and automated systems for recording and monitoring use of electricity and thermal energy;

3. use of automated control systems for technological processes and enterprises;

4. improving the fuel-energy balance of enterprises by comprehensive use of energy resources, primarily by the widest possible use of secondary (recycled) energy resources and also by decreasing direct losses of fuel, electricity, thermal energy, and other energy carriers;

5. refining technological processes, rational use of raw materials, decontamination and utilization of exhaust gases and effluent waters, introduction of closed (recycled) water supplies; development and introduction of fundamentally new energy technology complexes, building no-effluent and no-exhaust production facilities;

6. working out, for each sector, the strategic lines of action to increase the use efficiency of energy resources and cut specific energy expenditures to produce the primary types of output;

7. development and implementation of integrated future plans for energy savings at each enterprise for the five-year period;

8. refining the system of establishing energy use norms.

Energy workers have their holiday at a crucial period in their work cycle, the fall and winter period when electrical and thermal loads are highest. The provision of reliable, uninterrupted energy supply to the national economy in this period and strictest compliance with established limits and schedules of energy consumption by each enterprise will enable industry, construction, transportation, and agriculture to accomplish the tasks they face in carrying out the historic decisions of the 25th CPSU Congress.

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ELECTRIC POWER AND POWER EQUIPMENT

IMPROVING THERMAL ELECTRIC POWER PLANTS

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[Article by Denisov, V. Ye., Yakovlev, G. G., Lipovtsev, L. Ya, Korovin, V. P. "Work of the Soyuztekhenergo (ORGRES) on Raising the Technical Standard of Thermal Electric Power Plants (to the 45th anniversary of the organization)]

[Text] The Trust on Organizing and Improving Rayon Electric Power Plants and Networks (ORGRES) was created in 1933. In the prewar years, the ORGRES carried out start-up, adjustment and experimental work on new equipment at electric power plants in the USSR, as well as technical monitoring of the operation of electric power plants. This made it possible to raise considerably the standard of service and correlate the advanced experience of operation with the preparation of the necessary methodological, reference and informational data.

A great role in organizing a single technical policy in the area of equipment operation of power enterprises was played by the work begun in 1938 on preparing "Regulations on Technical Operation of Electric Power Plants and Networks" (PTE). These regulations were prepared by the ORGRES and took into account suggestions by workers in electric power plants, design, scientific research and installation organizations. The prepared PTE project was then reviewed and made more precise by a commission under the guidance of A. I. Letkov, deputy People's Comissar of Electric Power Plants and Electrical Industry of the USSR. In April 1940, M. G. Pervukhin, People's Comissar of Electric Power Plants and Electrical Industry of the USSR, approved the PTE as a compulsory document for the electric power plants and power systems of all departments.

The regulations stated the basic organizational and technical requirements for operating power facilities which would insure reliable and coordinated operation of all links of the power systems. They defined requirements for designing, building and installing power installations and the volume of their monitoring and automatic control facilities.

During the years of the Great Motherland War, when there was a great lack of electric power, the ORGRES activity was concentrated basically on providing for the reliable operation of electric power plants in the Urals and in Siberia, increasing their capacities and putting into operation new power installations. Methods were developed for burning high-ash coals and advanced methods were introduced for servicing -- reclaimation and stabilization of power oils at operating equipment, direct water intake from heat networks, accelerated methods for repairing equipment, etc. During this period, the ORGRES developed and introduced the method for repairing electric power transmission lines without disconnecting the voltage which was extremely important for supplying power to industry during the war.

Since 1943, the ORGRES has participated in restoring the electric power plants in the Center and South of the country. In the first postwar years, the basic direction in the work of ORGRES was the assimilation of new domestic equipment operating on high parameter steam (9.0 MPa, 500°C).

In 1953-1954, start-up and adjusting work was carried out successfully at the Cherepetskaya GRES on equipment with superhigh steam parameters (17.0 MPa, 555°C).

In the period of 1959-1965 inclusive, the basic activity of the ORGRES was assimilating 150,200 megawatt power units, as well as doing comprehensive work on the start-up and adjustment of 300 megawatt power units with supercritical steam parameters.

In the process of this work, the ties between the ORGRES and scientific research and planning organizations and plants that manufacture boiler-turbine equipment were strengthened.

ORGRES brigades carried out a large volume of work on 300 megawatt prototype power units on raising the reliability of the heating surfaces of boilers at various modes, finishing off the start-up modes of units and investigating various versions of start-up arrangements.

Methods were developed for prestarting chemical cleaning of the steam-water channel of the power units. For 150 and 200 megawatt units, the hydrazino-acid method became the most widely used one and for 300 megawatt units -- cleaning by an inhibited solution of citric acid and a solution of ammonium monocitrate. The experience obtained made it possible to develop typical arrangements for chemical purifications and specifications for equipment and chemicals.

The start-up method of using sliding steam parameters developed by the ORGRES for 150, 200 and 300 megawatt units with drum and direct-flow boilers played a great role in solving the problem of raising the reliability and time of start-up of power units.

Along with work done on 150-300 megawatt power units, preparatory work was done during this period on start-up and assimilation of new higher capacity 500 and 800 megawatt power units. ORGRES workers participated actively in designing prototypes of equipment and technological arrangements for these units which were installed for the first time at the Nazarovskaya and Slavyanskaya GRES, and in their start-up, adjustment and assimilation.

The acceleration of introducing and assimilating new kinds of power equipment and bringing up indicators for its operation to rated values is one of the main directions of scientific research progress of the industry. The ORGRES, converted in 1977 to the Soyuztekhenergo Production Association, and as the main organization is participating in assimilating all power unit prototypes and new kinds of equipments, in developing and introducing planning-design and technological developments that raise the technical standard of equipment operation at electric power plants. During the Ninth and Tenth Five-Year Plan periods, a considerable volume of comprehensive work was carried out on assimilating new equipment for 300 megawatt power units; on start-up and adjusting a new series of equipment for 800 megawatt units with single-housing boilers and single-shaft turbines at the Uglerodskaya and Zaparozhskaya GRES; 500 megawatt units at the Troitskaya GRES; gas-turbine equipment and new types of boilers and turbines for TETs.

Since 1971 alone, with the technical help by the Soyuztekhenergo, about 80 power units, with a total power of 25 million kw, including 800, 500 and 250 megawatt units, were put in operation at electric power plants.

As a result of the work done in cooperation with operating collectives of electric power plants, scientific research institutes, planning organizations and manufacturing plants, the reliability and efficiency of the 300 megawatt units were increased considerably and this group of equipment as a whole reached rated values. A complex of work is being completed on assimilating in operation and investigating the efficiency and the maneuverability of 800 megawatt units at the Zaporozhskaya and Uglerodskaya GRES.

The Soyuztekhenergo is taking part in developing progressive solutions in creating equipment for electric power plants of the Kansko-Achinsk Fuel-Power Complex. Berezovskiy coal was burned experimentally at the Vladivostokskaya TETs-2 and Krasnoyarskaya TETs-1 which made it possible to make the proper choice of a boiler design for the Berezovskaya GRES-1 -- the first electric power plant of the complex.

As a result of an investigation on furnace models at the laboratory of the Siberian Branch of the Soyuztekhenergo, a design was developed for a new in principle boiler with a circular furnace that is considerably lower.

A considerable amount of work was done in assimilating the burning of Ekibastuz coals. Modernization and operating mode measures were developed and introduced which provide higher wear resistance of coal grinding equipment, reliability of burners, stability of furnace operation and less erosion of the heating surfaces.

Jointly with the MO TsKTI [Moscow Branch of the Central Scientific Research, Planning and Design Boiler and Turbine Institute imeni I. I. Polzunov] and the Syzransk Turbine Building Plant, the design of a prototype of a 50 tons/hour hammer mill, adopted for series production for Ekibastuz coals, was finished off on a special test stand at the Troitskaya GRES.

Assimilation of equipment for 300 and 500 megawatt power units at the largest thermal electric power plants in the Urals and eastern regions of the country which operate on Ekibastuz coals -- the Troitskaya, Reftinskaya and Yermakovskaya GRES -- made it possible to develop and adopt reliable and efficient systems for pulverizing and burning pulverized coal.

The experience of assimilating 500 and 800 megawatt power unit equipment is used in developing design solutions for new equipment and technological arrangements for the new 1200 megawatt power units at the Kostromskaya GRES and the new 500 megawatt half-peak power unit at the Lukoml'skaya GRES.

Staff workers of the Soyuztekhenergo, jointly with plants, the VTI [All-Union Institute of Heat Engineering imeni F. E. Dzerzhinskiy], the TsKTI and operating personnel of electric power plants have participated actively in improving the hydro-dynamics of the steam-generating surfaces of supercritical pressure power units. The complexity of the problem lay in insufficient previous studies of the thermophysical properties of the working medium at supercritical pressures, the newness and variety of the adopted design solutions, and the necessity for simultaneous solutions of problems of hydrodynamics and temperature modes of pipes under conditions of high thermal stresses and internal sedimentations.

A large volume of tests and analytical-calculation work on TPP-110, TPP-210 and TPP-312 boilers made it possible for plants to modernize and, in a short time, provide the reliability of NRCh [expansion unknown] boilers of these types. Essential changes were made in the design of a large series of TGMP-314 boilers, which insured their practically faultless operation from the hydro-dynamic standpoint.

Boiler building plants, jointly with the VTI, formulated and introduced correlated recommendations on designing hydraulic arrangements for steam-generating shields for supercritical pressures. Tests of TGMP-324 and TGMP-204 boiler prototypes for the 300 megawatt Kirishskaya and 800 megawatt Zaporozhskaya GRES confirmed the reliability of the adopted arrangements.

On the basis of the experience of assimilating P-59 boilers, a method was developed for calculating the hydrodynamics in lifting panels of the NPCh when slagging. To increase the hydrodynamic reliability in multiflow loops of large boilers, pipe connections are used and a method for calculating complex hydraulic loops with cross connections was developed. The accumulated experience was utilized in designing new, more complicated boilers for the electric power plants of the Kansko-Achinskiy power-fuel complex, the semi-peak power unit and the 1200 megawatt power unit.

Work was also done to improve the maneuvering characteristics of thermal electric power plants, obtaining the limiting maneuvering possibilities of supercritical parameters of equipment, the conditions for their optimal modes and automation of the nonstationary modes of equipment operation.

The basic volume of work on the investigations and technological finishing-off of nonstationary modes and the improvement in start-up arrangements was done on supercritical pressure power units in recent years.

The technology was assimilated for the start-up of 300 and 500 megawatt power units with a combined heating of the system of intermediate superheating and with steam removed at the top of the strokes of the TsSD [Medium-pressure cylinder] and the TsND [Low-pressure cylinder] of the turbine, which made it possible to eliminate the ROU [Pressure-reducing and cooling unit] from the start-up arrangement.

On the basis of the obtained experience, typical start-up arrangements for 300 megawatt double-units and single units, and gas-fuel oil 800 megawatt single units were developed, and new typical instructions were issued for the start-up and stopping of 300 megawatt double and single units.

Tests were completed on a 300 megawatt double-unit in modes of starting it in accordance with the arrangement and technology of a single unit. This would make it possible to simplify the start-up arrangement considerably.

Work is being continued on the further simplification and reduction in the start-up time of power units by the use of new insulating materials and designs of thermal insulation.

In view of the fact that the unloading of basic power units is the basic method for their participation in regulating the daily schedule of the power systems, problems of expanding the regulation range and allowable maximum loads of the units acquired special attention. A considerably volume of investigations was made in this direction on changing over power units with supercritical parameters to a sliding pressure at partial loads, determining the overload capacity of power units and electric power plants as a whole, and introducing wide range automatic controls.

The assimilation of the power unit sliding pressure mode of operation made it possible to improve the work considerably when there were extensive reductions of load on the power units, especially those that are operated on gas-fuel oil. Losses were reduced due to throttling of steam, the static characteristic of the intermediate superheating temperature was improved and the operation of units on the turbine feeding pump for a wide range of loads was insured.

Modes of sliding steam parameters within limits and pressures at which stable hydrodynamics of loops is provided, were introduced at many electric power plants with 300 megawatt power units.

Close cooperation with manufacturing plants and scientific research institutes, as well as forms of organization of work jointly with the USSR Minenergomash [Ministry of Power Machine Building] that proved themselves, facilitated the successful solution of problems of raising the maneuverability properties of the equipment.

One of the most important directions of the Soyuztekhenergo's work is improving the control system for the 150,200 and 300 megawatt power units. Recently, basic attention in this direction was concentrated on developing, testing and introducing wide-range regulation systems, systems for regulating capacity, automated control of start-up and automatic systems for emergency unloading of units.

Wide-range systems for regulating the technological parameters of boilers were introduced on 300 megawatt power units at the Kirishskaya, Konakovskaya, Kostromskaya, Lukoml'skaya, Sredneural'skaya and other GRES. Unlike traditional arrangements, they include devices for the automatic correction of sensor characteristics and regulator settings, changes in the dynamic parameters of regulator tuning and functional converters. The Soyuztekhenergo developed such devices and methods for implementation on RPBI expansion unknown apparatus. Principles for synthesizing the regulation systems and their structure were changed in the process of introduction. Cascade arrangements of regulation with motor controllers, made on the basis of VMD [expansion unknown] devices were used widely.

The results of experimental and adjustment work by the Soyuztekhenergo on introducing systems for automatic power regulation were used to select an efficient version of the system. Such systems connected to central systems for automatic regulation of frequency and power, installed at dispatcher administrations, will be provided for over 100 300 megawatt and about 30 200 megawatt power units.

The Soyuztekhenergo participates in developing and introducing all-mode systems for automated control of technological processes (ASU TP) that act at start-up, stopping, regulating load and emergency situations. All power units 500 megawatt and higher are equipped with such systems. Recently, the basic efforts of technologists and specialists on automating equipment operation are being concentrated on ASU TP, differing qualitatively by new, higher standards, including the introduction of functional-group control (FGU) subsystems, automatic regulation, technological protection and computers.

For automation of start-up modes of power units equipped with traditional control systems, the Soyuztekhenergo developed an efficient and as compared to the FGU a simpler automatic control system (SAUP), that provides for automatic starting of the unit at various thermal conditions from the moment of firing the burner to when it reaches the normal steam parameters and the given loading. On the basis of operating a prototype of this system, typical solutions will be developed of SAUP for 150 and 200 megawatt power units with drum boilers and single 300 megawatt units operating on gas and fuel oil. Work on creating and introducing the FGU is being done on 500 and 800 megawatt pilot power units, as well as on a 1200 megawatt power unit. Of great importance in doing the work on these groups of equipment were the results of assimilating the FGU on a 300 megawatt power unit at the Kashirskaya GRES, equipped with burners and a control system of the "Pillard" Firm.

A considerable volume of work was done on assimilating computers for power units 300 megawatt and greater.

Since 1969, work has been done on creating and introducing at electric power plants automated water preparation installations with unitized connection of filters, which require minimum service personnel.

Designs of such installations were developed, adjustment and finishing off of the operating modes is being done and technical help is being given to electric power plants on automating previously designed installations on the basis of introducing nonstandard apparatus.

It should be noted that the wide introduction of the automation of chemical water purification at electric power plants is hampered by the unsatisfactory quality of the regulating equipment with anticorrosion coatings being supplied.

Recently, optimal modes were assimilated and introduced for 250 megawatt thermification units, as well as modes for raising the efficiency of the units by processing the boiler condensate more efficiently.

The Soyuztekhenergo made detailed tests of steam turbines of all series manufactured by domestic plants, including those for nuclear electric power plants. As a result of the tests actual thermal characteristics of turbines were obtained and calculated data were checked on the efficiency of the individual members of the flow-through part of the modernized turbines.

A great amount of work was done on assimilating and testing the pumping and auxiliary equipment of steam turbines for 150, 300, 300, 500 and 800 megawatt power units. Technical solutions were developed and introduced on raising the reliability of the regulation and oil supply systems, the optimization of the operating modes of the condenser installations and the equipment of thermal arrangements.

In view of the urgency of the problem of raising the efficiency of condenser installations in summertime, work has been done in recent years on developing and putting in practice optimal modes for operating water supply recirculating systems, efficient preventive maintenance methods and fighting against water reservoir and industrial water supply system pollution, and methods for removing low-temperature scale from condenser tubes.

Since 1962, the Soyuztekhenergo has been working on testing and developing systems for operational monitoring and regulations for servicing power gas-turbine installations. The association participated in assimilating prototypes of gas-trubine installations put in operation; the experience obtained was utilized in creating new types of more powerful gas-turbine installations with higher gas temperature ahead of the turbine with cooled vanes, as well as when assimilating steam-gas installations.

New developments and technical solutions by the Soyuztekhenergo for raising the technical standard of operation are used widely, as a rule, at power enterprises. They include: recipes for additives for an essential increase in life of transformer and turbine oils, improving the method for thorough drying of hydrogen and a series of automatic regulators for central water supply systems.

Finishing-off is being completed on regulators for the interlocking of heaters and compact pressure regulators for industrial thermification systems. The introduction of these regulators will make a sharp reduction possible in the unproductive expenditures of the heat carrier in these systems.

At some large electric power plants, a new design of beaters for hammer mills was developed and introduced. They will make it possible to increase the service life of heaters on the Moscow region coal and shale by 2.7 times and on Ekibastuz coal -- by 2.2 times. This design was adopted as a basis for standardizing beaters at all hammer mills.

In accordance with the Soyuztekhenergo design production was organized of crushing-milling machines, which eased considerably the labor of workers of fuel-transporting shops of electric power plants.

In recent years, investigations and design developments were made on modernizing the shut-off, regulating and protection equipment of 150, 200, 300, 500 and 800 megawatt power units, as well as on creating cut-off quick-acting gas and fuel oil valves of various diameters. All of these developments were introduced at electric power plants. Jointly with the TsNIIchermet [Central Scientific Research Institute of Ferrous Metallurgy imeni I. P. Bardin] a high strength heat-resistant alloy was developed for the nozzles of burners for boilers. The industrial use of these indicated that the life of the burners may be increased to 40,000 hours.

In 1971-1977 alone, the Soyuztekhenergo completed and adopted plans for series production over 290 planning-design developments, which were introduced at 400 power enterprises.

The Soyuztekhenergo gives technical help to power enterprises on improving the organization of production, and it correlates and disseminates advanced experience of the work of electric power plants and power systems.

The association constantly improves methods for setting norms and keeping records of fuel and analyzing its utilization and accounting at electric power plants.

A great deal of work was done jointly with power enterprises on setting norm indicators for all the basic and auxiliary equipment at electric power plants. Tests were made on all types of boilers and turbines in operation, on the basis of which typical norm characteristics were developed.

An analysis of the technical-economic indicators of equipment at electric power plants done on the basis of comparing actual monthly and annual indicators with norms makes it possible to detect deviations of its operating mode from optimal efficiently, make an objective evaluation of the work of the shift and repair personnel, and develop for each type of equipment technical solutions directed to further improvement of its work.

An investigation of several large electric power plants is made annually to raise the level of fuel utilization at these plants.

"Results of Operation of Thermal Electric Power Plants" is issued quarterly; "Review of Technical-Economic Indicators and an Analysis of Fuel Utilization at Rayon Thermal Electric Power Plants of the USSR Ministry of Electric Power and Electrification," as well as reviews of power unit operation are published annually.

Purposeful investigations made in recent years on large groups of electric power plants and the correlation of the obtained data made it possible, with the cooperation of industrial institutes, to prepare guide manuals and implement technical solutions to increase the tightness of the vacuum systems, the reliability of the regulation and steam distribution systems of steam turbines, the efficiency of the regeneration systems of the 300 megawatt units, the reduction in heat consumption for heating liquid fuel and other urgent problems of operating heating equipment.

Data and circulars on accident prevention are published on accidents that happened and makes it possible to carry out an efficient single technical policy on insuring reliable operation of the existing equipment.

Much work is being done by the Soyuztekhenergo on organizing the monitoring of the metal condition at electric power plants and power systems. Necessary methods and manuals were developed on monitoring welded connections and the basic metal. The following material was published in recent years with the participation of the VTI [All-Union Institute of that Engineering imeni F. E. Dzerzhinskiy] : "Instructions for Observing and Monitoring Metal in Boilers and Pipelines" and "Regulation on the Orders of Setting Periods of Further Operation of Boilers, Turbines and Steam Ducts that Operated Above 100,000 Hours."

In parallel with that, work is being done on improving monitoring-diagnostic documentation. A single document was prepared on monitoring and observing metal, which is effective for the entire period of equipment operation.

Work done in recent years on perlite steels made it possible to develop new criteria for their working capacity. The results obtained provide a basis to assume that the operational monitoring of the metal of heat-power equipment will become less cumbersome, more reliable and less expensive in the very near future.

A large number of directives and informational data were published which correlated the advanced experience of equipment operation, and work is being done on a systematic review of basic guiding data -- regulations for technical operation of electric power plants and networks, directive manuals, safety rules, technological design norms, etc. One of the most important papers was the review and issue of the 13th edition of the PTE [Technical Operation rules] .

Every year the Soyuztekhenergo and its enterprises conduct over 100 local, regional and all-union courses and seminars and about 200 conferences on various problems of equipment operation for power enterprise workers.

In recent years, the Soyuztekhenergo intensified work on the protection of the environment.

A considerable amount of work was done to raise the efficiency of removing ash from flue gases. Installations of "wet" cleaning with Venturi coagulators were developed and introduced at over 180 boiler installations; their installation made it possible to reduce the exhausts of ash into the atmosphere by about a million tons per year.

A considerable number of tests with consequent adjustment of electric filters is made annually; start-up and adjusting work is done on new inertial type of ash traps; at several electric power plants finishing-off work is done on modernized structures of electric filters and new devices for combined installations ("wet" stage of ash trapping and an electric filter), also of an ash trap with a high unit productivity.

At several electric power plants, measures were introduced to reduce the formation of nitrogen oxides directly in the furnaces. The new arrangement of recirculating flue gases, sent to independent channels around the bottom burners of the TP-87 boiler, halve the exhausts of nitrogen oxides; about the same reduction was obtained by modernizing burners of the TGMP-314 boiler.

Adjusting work is being done on the installation for the gasification of high sulfur content fuel oil being introduced at the Dzerzhinskaya TETs; much work was done on making the system for hydraulic ash removal more efficient and organizing the operation of ash dumps.

A considerable amount of work is being done on adjusting and organizing the operation of installations for cleaning the industrial sewage of electric power plants.

Data was collected and systematized on contamination sources, quality and composition of production sewage water, on the bases of which were developed: "Guiding Instruction on Preventing Contamination of Water Basins by Sewage Water from Electric Power Plants" and "Temporary Instructions on Servicing Installations for Cleaning Sewage Water from Electric Power Plants."

The association is working on solving the serious problem of protecting bodies of water from thermal "pollution" by the proper organization of discharging hot water into water reservoirs, reducing the amount of discharged heat by means of various types of sprinklers being developed.

The Soyuztekhenergo shares its experience with power engineering workers of socialist countries and provides great help in adjusting Soviet heat-power equipment sold abroad.

At all stages of development of Soviet power engineering, Soyuztekhenergo (ORGRES) specialists have worked in close cooperation with operating personnel of electric power plants, collectives of scientific research and planning organizations, introducing new equipment and correlating advanced production experience.

At present, collectives of the main Soyuztekhenergo enterprise in Moscow and enterprises in Sverdlovsk, Gorlovka, L'vov, Novosibirsk, Tashkent and Vladivostok are working successfully on solving the problems of raising further the technical standards of thermal electric power plants, on fulfilling the tasks placed before the power workers by the 25th party congress.

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ELECTRIC POWER AND POWER EQUIPMENT

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END PRODUCTS OF COMBUSTION

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[Article by Kropp, L. I., Zalogin, N. G., Yanovskiy, L. P. All-Union Thermotechnical Institute: "Indicator of the Total Harmfulness of Products of Combustion of Power Fuels"]

[Text] Products of combustion of fuels contain contaminating substances of varying toxicities. In some cases, it is necessary to characterize the quality of power fuels with respect to the pollution of the environment by one indicator that takes into account the sum of the amount of various contaminations ejected into the atmosphere and their toxicity.* Such a necessity may arise, for example, when setting for power fuels a correcting coefficient to existing prices which, at present, take into account only the mining and shipping costs. It may be assumed that in the future the price of fuels will be set to take into account the harmful effects of products of combustion on the environment. For example, the price of fuel should be increased if pyrites are removed from coal or part of the sulfur is removed from fuel oil. When one fuel is replaced by another at a TES, an indicator is necessary to evaluate the advisability of such a change with respect to environmental protection considerations. Such an indicator is also needed in evaluating the operation of an AES when, for example, several radioactive isotopes with various decay constants and radiation characteristics enter the environment. Such an indicator may characterize the relative harmfulness of using a given fuel in cities and regions with numerous enterprises responsible for background concentrations of contaminating substances and to a certain extent, for the unit costs of anti-pollution installations when using the given fuel.

* The sum in this case does not mean that the harmful admixtures have an equal effect on the human crganism.

The indicator of total harm $\Sigma\Pi$ of power fuels and the products of their combustion may be expressed by the sum of the partial indicators of harm:

$$\Sigma\Pi = \sum_{1}^{i} \Pi_i, \qquad (1)$$

where Π_i are values of partial indicators of harmfulness that characterize the unit quantity of the harmful substance and its relative toxicity.

Harmful admixtures of products of combustion of fuels may be divided into the following groups depending upon their origin.

The first group consists of harmful admixtures, the amounts of which in products of combustion depends very little on the technology of burning the fuel. It may be defined with sufficient accuracy on the basis of the composition of the fuel. This group consists of sulfur dioxide, fly ash, vanadium compounds, as well as other admixtures which pass into the composition of the ash when the fuel is burned.

The second group consists of harmful admixtures the formation of which in the products of combustion depends not only on the composition of the fuel, but also to a considerably extent on the scales, technology and mode of fuel combustion: capacity of the steam generator, method of preparing the fuel for burning, the design of the furnace, excesses of air, etc. This group consists of nitrogen oxides, carbon monoxide and other products of incomplete combustion of fuel, including hydrogen sulfides and carcinogenic substances. The ejections of these substances into the atmosphere vary strongly depending upon the enumerated factors, therefore, they are impossible to calculate without experimental data.

The third group consists of harmful admixtures due not to products of combustion of fuels at the TES, but to other sources, for example, dust from coal stock piles and ash dumps, release of carbohydrate vapors in systems for unloading fuel oil from RR tanks or river ships, ejections of fine particulates in open systems of pulverzied coal preparation, etc. The amount of ejections of this group compared to ejections of harmful admixtures with products of combustion is comparatively small, difficult to calculate and, therefore, will not be considered in the following.

The following considerations are used as the basis for determining the partial indicators that make it possible to compare and summarize the harmful effect of various admixtures contained in flue gases. The indicators must be reduced to a single dimension, in the quantitative respect -- to a unit of heat of combustion, while their relative toxicity is expressed in fractions of the value of PDK [Maximum permissible concentration] [1] of the given admixture.

Partial indicators of the harmfulness of the first group are determined by formula

$$П_i = \frac{0,35 Г_i F (100 - \eta) M_т}{Q^р_н ПДК_i M_г}, \qquad (2)$$

where $Г_i$ is the quantity of admixture in the working fuel, %; η_i is the rate of removal of the given admixture from the flue gases before they are ejected into the atmosphere, %; F is a nondimensional coefficient from the formula of dispersion of the exhausts in the atmosphere [2], equal to two for solid particles and to one for gaseous admixtures; M_T, $M_Г$ are molecular weights of the admixture in the fuel and in its products of combustion; PDK -- is the limit allowed concentration of admixture in the layer of atmospheric air near the ground, mg/m^3.

Partial indicators of the harm of the second group are determined from formula

$$П_i = \frac{3,5 C_i V_г (100 - \eta)}{Q^р_н ПДК_i}, \qquad (3)$$

where C_i is the concentration of the given admixture in $1m^3$ of the flue gases at normal conditions, $gram/m^3$; $V_Г$ is the volume of flue gases resulting from burning 1kg of fuel at normal conditions, m^3/kg; $Q^р_н$ is the lowest heat of fuel combustion, kcal/kg; η_i is the rate of cleaning of flue gases from the given admixture before the gases are exhausted into the atmosphere.

In the table for basic power fuels in the USSR are cited the results of calculated partial and total indicators determined in accordance with formulas (1), (2), and (3). Partial indicators of harm for sulfur dioxide and nitrogen, ash and vanadium pentoxide were determined. Not too much is known about other harmful admixtures in products of combustion of most fuels and is not taken into consideration. Nevertheless, it may be assumed on a reasonable basis that their determination and taking them into account will not reflect essentially on the order of products of combustion of fuels in their degree of harm.

The following initial data were used in the calculations: fuel characteristics [3] and the content of vanadium pentoxide. It is assumed to be equal to 0.03% for fuel oil with a sulfur content of 3%, while for other kinds of fuel oil -- it is assumed to vary in proportion to the sulfur content.

(24) Порядковый номер по $\Sigma П$	(25) Месторождение	$\Sigma П$	$П_{SO_2}$	$П_{NO_2}$	$П_з$	$П_{V_2O_5}$	$\Sigma П'$	(26) Порядковый номер по $\Sigma П'$
1	Сланцы эстонские	3,1868	0,0879	0,0681	2,89	0,42	0,1768	3
2	Подмосковный Б2	2,0156	0,1518	0,0636	1,42	0,38	0,2230	1
3	Экибастузский СС	1,8480	0,0300	0,0580	1,61	0,26	0,1066	8
4	Донецкий Г	1,6428	0,1070	0,0706	1,16	0,23	0,2005	2
5	Торф фрезерный	1,0228	0,0072	0,0756	0,45	0,49	0,0822	11
6	Ангренский Б2	0,9464	0,0562	0,0602	0,56	0,29	0,1239	6
7	Донецкий А	0,8707	0,0442	0,0565	0,59	0,18	0,1084	7
8	Донецкий Т	0,8044	0,0678	0,0604	0,58	0,16	0,1318	5
9	Львовско-Волынский Г	0,8366	0,0993	0,0572	0,53	0,18	0,1336	4
10	Райчихинский Б2	0,8100	0,0134	0,630	0,43	0,31	0,0842	13
11	Кузнецкий 1СС	0,6843	0,0074	0,0569	0,45	0,17	0,0706	19
12	Кузнецкий 2СС	0,6667	0,0085	0,0572	0,43	0,16	0,0720	15
13	Кузнецкий Т	0,6447	0,0090	0,0557	0,38	0,15	0,0700	20
14	Ирша-Бородинский Б2	0,6366	0,0075	0,0590	0,22	0,26	0,0712	18
15	Березовский Б2	0,4978	0,0075	0,0900	0,18	0,26	0,0718	16
16	Мазут S^p=3,5%	0,1381	0,0529	0,0440	0,0015	0,0397	0,1023	9
17	Мазут S^p=3,0 %	0,1284	0,0454	0,0440	0,0015	0,0340	0,1000	10
18	Мазут S^p=2,5 %	0,1131	0,0378	0,0440	0,0015	0,0283	0,0807	12
19	Мазут S^p=2,0 %	0,0971	0,0296	0,0440	0,0015	0,0221	0,0806	14
20	Мазут S^p=1,5 %	0,0842	0,0221	0,0440	0,0015	0,0166	0,0715	17
21	Мазут S^p=1 %	0,0714	0,0148	0,0440	0,0015	0,0111	0,0696	21
22	Мазут S^p=0,5 %	0,0578	0,0073	0,0442	0,0008	0,0055	0,0634	22
23	Природный газ	0,0378	—	0,0378	—	—	0,0378	23

1. Estonian shales
2. Near Moscow B2
3. Ekibastuzskiy SS
4. Donetskiy Г
5. Shredded peat
6. Angrenskiy B2
7. Donetskiy A
8. Donetskiy T
9. L'vovsko-Volynskiy G
10. Raychikhinskiy B2
11. Kuznetskiy 1SS
12. Kuznetskiy 2SS
13. Kuznetskiy T
14. Irsha-Borodinskiy B2
15. Berezovskiy B2
16. Fuel oil
17. "
18. "
19. "
20. "
21. "
22. "
23. Natural gas
24. Ordinal number for $\Sigma П$
25. Deposit
26. Ordinal number for $\Sigma П'$

The vanadium content in all solid fuels is assumed conditionally to be the same and equal to 0.09% [4]. The toxicity of solid fuel ash was assumed to be equal to that of nontoxic dust (PDK = 0.5 mg/m^3). The concentration of nitrogen oxides in flue gases was assumed on the basis of high unit capacity power units and for most fuels was taken from experimental data at normal conditions and a coefficient of excess air equal to unity. These values must be made more precise for concrete calculations. For vanadium pentoxide, the medical organs of the USSR set only average daily limits for the allowable concentration, therefore, it is related to the average daily value of the PDK of nontoxic dust equal to o.15 mg/m^3 [1].

Calculations were made for two cases. In the first the partial (Π_i) and the total ($\Sigma\Pi$) indicators of harm were calculated for products of combustion, leaving the boilers, and characterized the harm of uncleaned gases. In the second case, the value of $\Sigma\Pi'$ was calculated taking into account ash trapping and characterizing the total exhaust of harmful admixtures into the atmosphere. The value of $\Sigma\Pi'$ was determined on the assumption that 99% of the particulates are removed from the products of combustion of solid fuels before they are exhausted into the atmosphere.

In calculating the $\Sigma\Pi'$ for fuel oils, it is assumed that when ash traps are used, the rate of trapping ash and vanadium compounds is 70%.

The order of arrangement of fuels in the table in correspondence with the value of harm indicator $\Sigma\Pi'$ is somewhat different compared to $\Sigma\Pi$. When flue gases are removed from ash, low sulfur content solid fuels (peat, Kuznetsk and Kansko-Achinsk coals) are found to be among the least harmful, while, for example, high sulfur content fuel oil (S^p_{ob} = 3.5%) shifts from the 16th to the 9th place. When no ash traps are used on fuel oil boilers, as is the practice at present, fuel oil appears in 4th place with respect to the sum of harmful admixtures in products of combustion. As shown in the table values of $\Sigma\Pi$ vary within limits of 3.1565 for Estonian shales to 0.0378 for natural gas, i.e., by almost two orders of magnitude. This attests to the necessity of giving serious consideration to environmental protection problems when changing the fuel at TES. Values of total and partial harm indicators indicate in what cases it is possible to obtain positive results in protecting the environment against pollution when changing the fuel supply and vice versa.

In the upper part of the table are located primarily solid fuels of deposits in the European part of the USSR (with the exception of the Ekibastuz coal) and in the lower -- of the Asian part.

Products of combustion of low sulfur content coals such as, for example, Kuznetsk, where efficient ash traps are used have lower indicators of harm $\Sigma\Pi'$ than products of combustion of high sulfur content fuel oils.

The relationship of partial indicators of harm Π_{SO_2} and Π_{NO_2} in products of combustion of solid fuels helps in selecting the direction of work in fighting air pollution. Thus, for example, for the coal mined near Moscow $\Pi_{SO_2} = 0.1518$ and $\Pi_{NO_2} = 0.0638$. Taking into consideration the total effect of these admixtures, it is possible to conclude that for such coal the basic source of air pollution is sulfur dioxide and a reduction in contamination by nitrogen oxide would be insignificant in the total effect. For Berezovskiy coal respectively $\Pi_{SO_2} = 0.0077$ and $\Pi_{NO_2} = 0.06$, i.e., a reduction in air pollution by gaseous admixtures may be achieved basically by reducing exhausts of nitrogen oxides.

One progressive direction in building TES is enlarging the capacity of power units and the TES themselves, because this reduces unit capital investments in construction. However, this is true only when building the power part of the TES. With the increase of TES capacities and the volume of flue gases, it is necessary to increase the height of the stacks. The cost of the stacks increases approximately proportionally to the cube of the height. Solving the problem of ash trappings is related not only to increasing the volume of the apparatus, but also to increasing the requirements for the efficiency of gas cleaning, as well as overcoming design difficulties, which increase the unit capital investments in ash trapping. With the increase in the area of ash dumps, it becomes necessary, as a rule, to increase the length of the ash ducts, water cleaning lines, as well as incurring additional expenditures to prevent the clean water from filtering through the dams surrounding the ash dumps. This increases unit capital investments in building antipollution installations with greater power of the TES and, therefore, reduces the economic efficiency in building power facilities in this direction. Other conditions being equal, increasing unit capital investments, depends on the characteristics of the fuel used, the sum of which is expressed by the value of $\Sigma\Pi$. The greater $\Sigma\Pi$ is, the higher the unit expenditures for protecting the environment and the lower the gain from increasing the power of the TES. The advantages of building more powerful TES may be most fully realized by using natural gas for fuel and considerably less fully -- by using fuels located in the upper part of the table. Thus, the value of $\Sigma\Pi$ may be a useful indicator also in solving the problem considered.

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FUELS AND RELATED EQUIPMENT

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OIL AND GAS PROSPECTS IN KRASNOYARSKIY KRAY

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[Article by V. V. Grebenyuk, A. E. Kontorovich, N. V. Mel'nikov, V. S. Starosel'tsev and V. S. Surkov (SNIIGIMS [Siberian Scientific Research Institute of Geology, Geophysics and Mineral Raw Materials]), V. D. Nakaryakov, V. G. Sibgatullin and V. D. Tokarev (Krasnoyarskneftegazrazvedka), and A. A. Trofimuk (IGiG SO AN SSSR [Institute of Geology and Geophysics, Siberian Department, USSR Academy of Sciences]): "Main Directions of Geological Exploration for Oil and Gas in Krasnoyarskiy Kray During the Concluding Years of the Tenth Five-Year Plan"]

[Text] The decisions of the 25th CPSU Congress state that one of the most important tasks for geological exploration during the Tenth Five-Year Plan is more rapid location and exploration of new reservoirs of oil, natural gas and gas condensate in East Siberia. Forecasts show convincingly that a large proportion of geological reserves of hydrocarbons on the Siberian platform are concentrated in Krasnoyarskiy Kray [1, 3, 4]. Geological and economic calculations conducted by SNIIGIMS, VNIGRI [All-Union Petroleum Scientific Research Institute of Geological Exploration (Leningrad)], the Sevmorgeo NPO [Scientific Production Association], IGiG SO AN SSSR and the Krasnoyarskneftegazrazvedka trust assume a rapid growth of geological exploration work and of certifications following its conclusion. This will make it possible to identify the main patterns of formation and distribution of hydrocarbon accumulations in the Tungus syneclise and adjoining territories and in various structural and facies zones of the Yenisey-Khatanga Basin, and to determine the areas in which prospecting and exploration should be conducted.

Promising oil and gas areas within Krasnoyarskiy Kray fall into two oil-gas provinces (NGP): the Lena-Tungus and Khatanga-Vilyuysk provinces [3], and the small Minusinsk gas region and the western part of the West-Siberian oil-gas province. The Lena-Tungus Province includes the North Tungus, South Tungus, Katanga and Sayan-Yenisey oil-gas areas (NGO: Neftegazovaya Oblast') and the Turukhanskiy-Noril'sk oil-gas region. The Yenisey-Khatanga oil-gas area is in the Khatanga-Vilyuysk oil-gas province. The above-mentioned oil-gas areas correspond tectonically to major structures of the Siberian platform: the North Tungus and Sayan-Yenisey areas to the Kureyskiy and Sayan-Yenisey syneclises, the South Tungus area to the Baykiy anteclise, the Katanga area to the Katanga saddle and the southeastern edge of the Kurey syneclise (the areas of the Chunskiy and Ilimpeyskiy arches), the Turukhanskiy-Noril'sk oil-gas region to the Turukhany-Noril'sk ridge, and the Yenisey-Khatanga area to the downwarp of the same name.

As of 1 January 1978, about 664,000 meters of deep wells had been drilled. The quantity and density distribution over the individual areas and regions of the Khatanga-Vilyuysk, Lena-Tungus and West Siberian provinces are shown in the table.

Oil-Gas Area or Region	Quantity of Drilling, 1000 m	Density of Drilling, m/km^3
Yenisey-Khatanga	310	1.3
Minusinsk	153	5.0
Sayan-Yenisey	58	0.4
South Tungus	43	0.15
Part of West Siberian province in Yenisey area	38	0.13
Turukhanskiy-Noril'sk	28	0.84
North Tungus	21	0.09
Katanga	3	0.01

In spite of the extremely low level of knowledge of the Krasnoyarsk territories on the basis of deep drilling, geological information already obtained can, when combined with data from geophysical researches, serve as the basis for a quantitative evaluation of initial potential hydrocarbon resources. In the Lena-Tungus province, for example, they are concentrated primarily in the North Tungus, South Tungus and Katanga areas, and to a less degree in the Sayan-Yenisey area [4].

The following main directions for geological exploration for oil and gas have been laid down for the Khatanga-Vilyuysk province:

location of oil and gas (with a high condensate factor) and gas condensate pools in Jurassic deposits in already-discovered fields and new areas in the western part of the Yenisey-Khatanga area;

a search for oil and gas pools in Permian and Triassic formations in the eastern part of the Yenisey-Khatanga area;

evaluation of the oil and gas prospects of Paleozoic and lower Mesozoic rocks in the western part of the Lena-Anabar area (Anabar-Khatanga region).

The large oil and gas forecasts for the extensive northern territory of Krasnoyarskiy Kray are being confirmed by geological exploration. In the western part of the Yenisey-Khatanga basin, for example, a relatively small amount of deep drilling has identified several gas and gas condensate pools in Cretaceous (primarily) and Jurassic deposits. The central, northern and particularly northeastern regions of the basin have been studied extremely little, although these regions are extremely promising in the search for hydrocarbon accumulations in anticlinal traps. Moreover, the pinching-out zone of the lower and middle Jurassic formations which extend along the northern flank of the depression from the gulf of the Yenisey in the west to Lake Taymyr in the east is favorable for the formation and storage of large hydrocarbon accumulations in non-anticlinal traps. A regional pinching out of individual complexes of middle Paleozoic deposits is possible on the southern flank of the Anabar-Khatanga saddle from the mouth of the Kotuy River in the west to the middle Popigay River in the east, where Permian rocks lie on the eroded surface of Cambrian deposits.

Data from deep drilling on the Payutskaya, Tanamskaya, Srednepyasinskaya and Balakhninskaya sections make it possible to suggest that the Jurassic and the lower portion of the Cretaceous formations have become shaly from the edge in toward the axial area of the basin. The sandy and shaly deposits of the Sukhodudinian suite (later Valangian-Hauterivian), for example, which within the Tanamskiy Arch and the Rassokhinskiy Swell contain gas-bearing sandstone horizons, are replaced to the north and northeast (along the axis of the basin) by shaly aleurite rocks which are practically devoid of permeable horizons. Judging by drilling data from the Barakhinskiy section, Jurassic deposits seem to undergo similar facies changes. Conditions favorable to oil and gas accumulation are expected in these deposits on the inclined northern flank of the Yenisey-Khatanga Basin in a zone 100-150 kilometers wide and about 600 kilometers long from the mouth of the Yenisey in the west to the western end of Lake Taymyr in the east. Prospects here are confirmed only by a single test well on the Deryabinskaya section, located at the extreme west of the territory, where a powerful flow of gas and condensate was obtained from upper Jurassic deposits. A more confident evaluation of oil and gas prospects in this zone requires the sinking of a series of test wells along the northern edge of the basin, primarily on the Gol'chikhinskaya, Tareyskaya, Yangodo-Gorbitskaya, Logatskaya and Kubalakhskaya sections. The location and structural properties of the test wells have already been determined for the first two sections. Additional seismic exploration will be required for precise siting on the other three sections.

On the eastern side of the Yenisey-Khatanga basin, evaluation of the oil and gas prospects of Lower Carboniferous and Jurassic deposits in the northeastern regions of the Rassokhinskiy Swell (Novoye, Kur'inskoye and Volochanskoye local uplifts) and the eastern part of the North Siberian monocline (left bank of the Khatanga River in the sector between the mouth of the Kotuy in the southwest and the lower Bolshaya Balakhna in the northeast) is of considerable interest. The location of test wells has been determined for the Volochanskaya and Novaya sections. Seismic exploration work must be conducted in order to select suitable structural conditions for the sinking of test wells on the Novaya and Bolshaya Balakhna rivers.

The eastern half of the Yenisey-Khatanga basin and particularly its southern flank (from the mouth of the Kotuy in the west to the Anabar River in the east) are extremely promising for the discovery of oil pools in Permian deposits, as indicated by the extensive highly bituminized zone of Permian sandstones on the northern slope of the Olenekskiy Arch and the obtaining of a flow of oil from Lower Permian rocks on the Tigyanskaya section [2]. One of the high-priority sites on the southern side of the basin is the Kostroma Swell, whose general areal structure has been determined by seismic exploration. On the arch of its western dome it is planned to sink a test well to give information on Permian and possible Cambrian deposits. In addition it is planned to drill test wells on the arch of the Tigyan-Anabar Swell and in the central part of the Anabar-Khatanga saddle on the upper course of the Suolam River.

Thus, in order to study regional structure and to evaluate the oil and gas prospects of only the most promising parts of the Yenisey-Khatanga Basin, it will be necessary to drill 11-12 test wells in the next few years.

In the Lena-Tungus oil-gas province the following directions have been designated the primary ones for geological exploration for oil and gas:

study of the regional structure of the territory so as to locate and map out oil and gas accumulation zones; determination of the reservoir distribution patterns for productive complexes and their roof rock, along with determination of their parameters; determination of spatial differentiation in oil and gas accumulations; and more precise quantitative estimation of the region's oil and gas prospects;

preparation of large hydrocarbon reserves within the oil and gas accumulation zones identified.

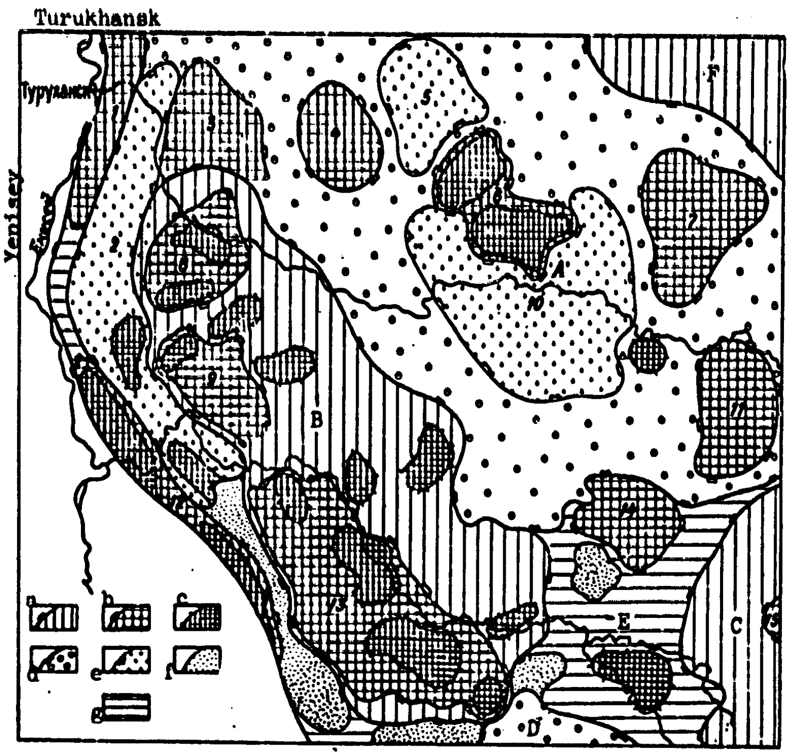
Judging by geological and geophysical data, the most promising oil and gas areas for location of large oil and gas accumulations may be the North Tungus (Kurey syneclise), South Tungus (Baykit anteclise) and Katanga (Katanga saddle) areas.

The Kurey syneclise occupies a large area (1000 x 600 km) between the Turukhanskiy-Noril'sk ridge and the Baykit anteclise on the north and the Anabar and Nepsko-Botuobinskit anteclises on the east. On the south it is bounded by the Katanga Saddle, and on the north by the Yenisey-Khatanga basin; Lower and Middle Paleozoic deposits are distinguished in the modern areal structure. The main hydrocarbon resources within this area are concentrated in the marine and lagoon-marine formations of the Lower and Middle Paleozoic. Information on the structural layout of promising horizons is extremely sparse. On the basis of regional soundings with reflection and refraction seismometry, four zones of arch-like uplifting in the cover and basement rock have been identified in the area of the Kureyka and Severnaya rivers (Anamskiy Arch), and in the cover in the basin of the Viva, Kochechum and Indym rivers (the Yuktelinskiy and Kochechumskiy Arch and the Indym dome uplift). Their areas range from 5,000 to 20,000 square kilometers, and their amplitudes up to 1,000 meters in the basement complex and 300-400 meters in the cover. Gravimetric-magnetic and electrical data from the central part of the Kurey syneclise identify three more arches: the Ledyanskiy, Ayanskiy and Turunskiy, with areas ranging from 10,000 to 22,000 square kilometers. These large positive structures are of definite interest in the search for hydrocarbons. However, it is still unknown whether they are closed, what their real dimensions and shapes are, at what levels in the section the reservoirs are located, and what the physical properties of reservoir strata that have developed there are. Unambiguous answers to these questions may only be obtained after a large quantity of regional geophysical investigation and the drilling of test wells. Geophysical work on reference and regional sections is planned, comprising a complex of seismic, electric, magnetic and gravimetric methods. Regional prospecting will make use of seismic and electric methods. In 1978-1980 the first test wells will be drilled in the first- and second-priority structures identified by seismic prospecting: the Anamskiy Arch and the Untuunskiy and Indymskiy dome uplifts.

The Baykit anteclise (750 x 300 km) extends along the southwest edge of the Siberian platform. It comprises the basins of the middle and lower Podkamennaya Tunguska and part of the lower Nizhnaya Tunguska (see figure). The anteclise is separated from the Angara folds, the Yenisey shelf and the Turukhansk-Noril'sk ridges by a narrow trough whose minimum depth toward the eastern part of the Yenisey Shelf is a few hundred meters, while north and southeast of this sector it increases to 400-700 meters. Within the Baykit anteclise are distinguished three first-order structural elements: the Kamovskiy Arch, comprising the southern, most uplifted part; the Bakhtinskiy ridge, which is an extensive terraced structure located to the north of the Kamovskiy Arch; and the Suringdakonskiy Arch, comprising the northern, most deeply buried section of the anteclise.

The first oil and gas pools were located in the northern part of the Kamovskiy Arch (Kuyumbinskaya section). Flows of oil and gas were obtained from carbonate deposits whose absolute age was determined by the potassium-argon method as 1080-1200 million years, corresponding to the Middle and Upper Riphean. The deeply eroded Riphean deposits are overlain, with angular unconformity, by sedimentary carbonates of the Motian suite of the Lower Cambrian. The structural layout of the Riphean formations within the Kuyumbinskaya section has been mapped out very sketchily from seismic data. It appears that a large anticline has developed, with granite-gneiss basement rock appearing at the Precambrian erosional surface and with slopes composed of clastics and carbonate rocks of the Middle and Upper Riphean complexes.

The differences in elevation between the gas-oil and oil-water interfaces make it possible to hypothesize the existence of several independent deposits in the Riphean strata. They may be located in both reservoir strata of different thicknesses and in carbonate series of the Riphean separated by shaly layers. The spaces in the latter were apparently formed through karst development in the carbonates during the pre-Motian interval. The deposits are capped by shaly carbonate deposits of the Motian suite of the Lower Cambrian. The fluids are contained in vuggy-fractured and cavernous-fractured carbonate reservoirs. Judging by the large oil and gas yields, the filtration characteristics of the latter reservoirs are satisfactory.



Tectonic Regions of Central Krasnoyarskiy Kray

Key:

Positive structures:
a. Major structures
b. First-order structures
c. Second-order structures

Negative Structures:
d. Major structures
e. First-order structures
f. Second-order structures

g. Intermediate structures

Main structural elements:
A. Kurey Syneclise (southern part)
B. Baykit Anteclise
C. Nepsko-Botuobinskaya Anteclise (western pericline)
D. Sayan-Yenisey Syneclise (northern centricline)
E. Katanga Saddle
F. Anabar Anteclise (southwestern pericline)
1. Kurey-Baklanikhinskiy Swell
2. Lower Tungus Downwarp
3. Onekskiy Projection
4. Yuktelinskiy Arch
5. Upper Kochechum Depression
6. Kochechum Arch
7. Turun Arch
8. Suringdakonskiy Arch
9. Bakhtinskiy Projection
10. Turinskiy Depression
11. Ilimpeyskiy Arch
12. Vel'minsko-Lebyazhinskiy Swell
13. Kamovskiy Arch
14. Chunskiy Arch
15. Nepskiy Arch (western pericline)

The distribution of oil and gas pools in the Kuyumbinskaya section is controlled by the Riphean structural pattern. The bedding angles of the rock range from 10° to 45°. The thicknesses of carbonate suites reach 600-800 meters. It appears that the deposits are distributed in bands. The breadths of the individual bands may be several kilometers in massive stratigraphically enclosed deposits and several hundred meters in stratigraphically enclosed beds.

The oils in the Kuyumbinskaya pool are light (0.79-0.84 g/cm^3), low in sulfur (less than 0.2%) and low in paraffin (less than 2%), and have less than 6% of tar and a yield of up to 40% of light fractions. In hydrocarbon content they are essentially aliphatic, much resembling oils from the Lower Cambrian and Wendian deposits of the Angara-Lena and Nepsko-Botuobinskaya areas. They differ only by a slightly higher cyclane content and an increased degree of condensation.

The almost universal distribution of Riphean formations of significant thickness within the Baykit anteclise expands the range of deposits with oil and gas promise. Geological data enable us to predict the existence in the Kamovskiy Arch area of other buried Riphean uplifts structurally similar to the Kuyumbinskiy uplift. On the southwestern and southern limbs of the Kamovskiy Arch, terrigene strata of the Lower Motian subsuite underlying carbonate rocks of the Motian suite have been discovered by the Tayginskaya and Nizhnetayginskaya test wells. The wedging-out zone of the Lower Motian sandstones along the southwestern and southern slopes of the Kamovskiy Arch is of interest in the search for lithologically and stratigraphically segregated deposits similar to those found on the limbs of the Nepsko-Botuobinskiy anteclise. In addition, oil and gas pools may be found within the arch in Lower Cambrian intersalt deposits, particularly in the cover of the Motian suite and the Osinskiy horizon of the Usol'skaya suite. Thus it is advantageous to continue the search for buried Riphean uplifts by deep drilling on the Kamovskiy Arch, to establish the presence and approximate outline of wedging-out zones of the sandstones on the limbs and to evaluate the oil and gas prospects of the Lower Cambrian salt-bearing complex within the largest and most reliably prepared local uplifts.

Another promising area is the northern part of the Baykitskiy anteclise (basin of the upper Bakhta and the lower Nizhnaya Tunguska). Here are located the Bakhta Ridge and the Suringdakonskiy Arch. The main productive horizons should be expected in the vuggy and cavernous dolomites of the lower, middle and especially the upper Kostinskaya suite of the Lower Cambrian, in the sandstones of the Baykit suite of the Lower Ordovician and in the organogenetic dolomites and limestones of the Wenlockian stage of the Silurian. These complexes have excellent or satisfactory reservoir characteristics, combined with capping horizons.

In the northern part of the Baykit anteclise, the sedimentary cover is disrupted by numerous intrusions, rendering description of the structures in terms of the various horizons more difficult and making it hard to prepare them by geophysical methods. During the next few years it will be necessary to study the regional structure of these territories, to locate trap bodies in the section, to map out the zones containing horizons with excellent or satisfactory reservoir characteristics, and to locate them more precisely in section and areally, which will make possible more systematic preparation of local uplifts and a selective designation of the latter for deep wildcat drilling. The top priority test wells are Onekskaya and Bil'chanskaya wells on the extreme northern limb of the Baykit anteclise and the Kochumdekskaya on the southeastern limb of the Bakhta ridge.

The very first test well, the Vanavarskaya, drilled in the Katanga oil and gas area, located two promising horizons: sandstones in a lower subsuite of the Motian suite and Riphean dolomites. The thickness of the former was more than 30 meters and their depth 3135-3168 meters, with the upper part saturated with oil. A commercial flow of oil was obtained on testing of the top 7 meters with a formation tester. The sandstones are covered by a 60-meter layer of argillites and aleurolites. The oil has a density of 0.82 g/cm^3, contains 0.18% sulfur, and yields 46.7% light fractions. The Riphean deposits were found in the 3196-3333 meter range. They were large-crystalline, dense, large-cavernous dolomites alternating with layers of greenish-gray argillites.

It appears that the sandstones of the lower subsuite of the Motian suite and some of the Riphean dolomites are the main targets for oil and gas prospecting in the Katanga area. Other promising horizons may be found in the Bulayskaya suite, the Nizhnebel'skaya subsuite, the Osinskiy horizon and the upper part of the Motian suite. Drilling of the Sobinskaya, Sol'zavodskaya and Ilimpeyskaya test wells is planned for the next few years in order to map out zones of occurrence of sandstones in the Motian suite and to determine their thicknesses and reservoir characteristics.

The great extent of terrigene and explosive formations of the Upper Paleozoic and Triassic with thicknesses up to 1,000 meters is making preparation of the structures by geophysical methods much more difficult. Accordingly it is planned in those cases to combine seismic prospecting with core drilling. Extensive use will also be made of electrical prospecting by establishing the field in nearby zones, which is expected to help refine the structural plan of the Vanavarskaya sector and determine the location of the water-oil interface.

The completed and planned work in the various regions of Krasnoyarskiy Kray is only the beginning of a major program of regional and prospecting-exploration work aimed at faster location of oil and gas accumulation zones and a higher geological and economic effectiveness for oil and gas prospecting in the extermely complex geological conditions of the Siberian Platform.

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FUELS AND RELATED EQUIPMENT

UKRAINIAN COAL PRODUCTION GAINS NOTED

Kiev UGOL' UKRAINY in Russian No 1, Jan 79 pp 1-4

[Article: "More Coal for the Country!"]

[Text] Every new year has its own distinctions. The start of this one is special. It is taking place in an atmosphere of a great political and labor upswing, caused by the decisions of the November 1978 Plenum of the CPSU Central Committee. At the Plenum comrade L.I. Brezhnev said: "We are continuing to put a limit on metal and fuel. In order to insure the development of ferrous and nonferrous metallurgy, the oil, gas and coal industries, in three years more than 50 billion rubles was expended, and allocated for 1979 is almost 23 billion more. As you see, these are not small amounts. Nevertheless the assignments for introduction of capacities and for the production of ferrous and nonferrous metals, and for the extraction of coal and oil are not being completely fulfilled."

In order to overcome the lag, urgent measures were outlined, among which an important role is set aside for socialist competition. "We have also such a tested lever for multiplying labor successes as the socialist competition. Having become by its scope and depth truly national, the competition constantly gives birth to models of creative labor, it is a good service for the development of the country's economy," pointed out L.I. Brezhnev at the Plenum of the CPSU Central Committee.

We have entered the fourth year of the Tenth Five-Year Plan, and depending on the work during this year is fulfillment of the five-year plan as a whole. The communist party and the Soviet state are devoting constant attention to the development of the coal industry.

In the resolutions of the Central Committee of the party and the government "On Measures for Development of the Coal Industry of the Donets Basin in 1976-1980," and "On Granting Additional Privileges to Workers in the Coal and Shale Industry and Mining Construction" the specific ways are determined for speeding up the construction, rebuilding and technical retooling of the mines, concentrating mills and plants in coal machine building; and a broad program is outlined for improving labor protection and safety engineering, health protection and sociocultural measures (in particular, raising wage rates, the amounts of awards for years of service, and old-age pensions).

Measures for material and moral incentives, and broad privileges and advantages will elevate miners' labor still more. Outfitting the coal industry with modern mining equipment, and skilful mastery of it are a guarantee of successful work.

Many workers and collectives of enterprises of the Ukrainian SSR Ministry of the Coal Industry are successfully fulfilling the plans and socialist obligations. Completed by the anniversary of the new Constitution of the USSR was fulfillment of the three-year plan by 40 mines, 207 extraction sections, 253 extracting and 114 tunneling brigades, and 3,000 mine-face workers, 47 of whom fulfilled the plan for four years of the five-year plan. And mine-face workers Hero of Socialist Labor P.Ye. Lisnyak (mine imeni Artem), and honored miners of the Ukrainian SSR V.G. Grinev (mine imeni Izotov) and V.P. Markin ("Kochegarka"), A.G. Khvorostyan (mine imeni Lenin), and L.I. Deyev ("Toretskoye" mining administration) completed their five-year plans in 1978. Three-year plans for extraction of coal were fulfilled early, in November 1978, by the associations of Donetskugol', Ukrzapadugol', Krasnodonugol', Shakhterskantratsit, Ordzhonikidzeugol' and Pavlogradugol'. An example of a skilful, creative approach to utilization of equipment and reserves of production is the work of the collectives of the mines imeni gazety "Sotsialisticheskiy Donbass," "Ukraina," imeni Frunze, "Ternovskaya," No. 3 "Velikomostovskaya," and many others, which are increasing the rates of extracting from year to year.

The pride of workers in the coal industry are the thousander-brigades. At the source of the thousander movement was the brigade of twice-hero of Socialist Labor I.I. Strel'chenko from the "Trudovskaya" mine. Having mastered to perfection the narrow-grip equipment and technology of extraction, back in 1964 this collective guaranteed a daily extraction of 1,000 tons of coal and more, which exceeded four-fold the average load per longwall for the republic. The section, which is now headed by mining engineer I.I. Strel'chenko (brigade leader A.D. Polishchuk) is the initiator of a campaign for preservation and long life of mining equipment, and since the start of the five-year plan it has extracted 2.5 million tons of coal. Over 3 million tons was contributed since the start of the five-year plan by the brigade of Hero of Socialist Labor V.G. Murzenko ("Krasnyy Partizan" mine) and I.Ya. Kolesnikova (Molodogvardeyskaya"). Increased pledges are being fulfilled by the brigades headed by Hero of Socialist Labor G.I. Motsak (imeni Kosmonavtov), by honored miners P.A. Kaminskiy ("Butovka-Donetskaya") and V.I. Ignat'yev ("Krasnolimanskaya"), by honored miner of the Ukrainian SSR A.A. Asyutchenko (im. gazety "Sotsialisticheskiy Donbass") and other collectives which, having used reserves to the maximum, brought the daily load at the longwall up to 1500-3000 tons.

Crowned by a record achievement was the shock watch in honor of Miner's Day by the brigade of Hero of Socialist Labor V.P. Sokolov from the mine imeni Chelyuskintsev. In 31 working days it cut a drift of 1200 meters. The new record was set by V.A. Nelepinskiy's brigade from the Donetskshakhtoprokhodka Trust. In June in 25 working days it cut a shaft of 100 meters at the mine imeni Kalinin, having attained the highest labor productivity--13.57 cubic meters per shift. Also with high rates of cutting are the brigades led by V.G. Vendilovich (mine imeni Abakumov), Hero of Socialist Labor I.M. Naumov ("Znamya kommunizma"), winner of the USSR State Prize V.I. Demeshko ("Pavlogradskaya") and others. On their initiative operating in the sector are 193 brigades of high-speed workers against 80 at the start of the five-year plan.

What is the secret of success of the front-ranking brigades? In the coal industry it is difficult to find two mines with absolutely identical working conditions. In each specific case it is necessary to consider the mining-geological, technical, economic and other factors. And still with all the differences in the methods of coal removal or tunneling there is much in common in their work. First of all this is scientific organization of labor, a good moral climate in the collective, advanced training, and increasing labor discipline. In the front-ranking collectives they are concerned not only about fulfillment of the plan, but also about growth in labor productivity, and improving the quality of the coal. Mining equipment is used with the maximum effectiveness. In the brigades full interchangeability has been achieved, and the miners know all the mining specialties. Special attention is given to preventive repairs.

Thanks to the selfless labor of the advanced brigades, sections and mines since the start of the five-year plan, more than 6 million tons of coal has been extracted above the plan. Work has been done for further improvement, for mechanization and automation of production and technological processes. There was a marked rise in the number of fully mechanized mine faces, the volume of extraction from which was increased 1.3-fold by comparison with 1975. Now about 58 percent of the coal is yielded from mines working sloping beds with the use of mechanized timbering. Use of cutting-loading machines on the drifts has increased 1.4-fold. In addition, many production associations and mines of the sector last year did not use all the reserves, they worked below their potentials. The annual volume of extraction taking into account the additional assignment envisaged in the plan for deliveries of fuel to the consumers was not fulfilled by the republic's coal industry.

The main reason for the sector's lag was the reduction in the volumes of preparatory operations, as a result of which many associations and mines were not provided with the necessary and quality front of working faces. The Pervomayskugol' association had a significant lag in the development of mines and preparation of the front of extraction operations.

Reduction of the front of extraction operations, a worsening of its quality, and the absence of an effective reserve line occurred at mines of the Donbassantratsit Association. In the Artemugol' Association the volume of performance of preparatory excavations in 1976-1977 was reduced by 16 kilometers, or by 4.5 percent, and the plan was not fulfilled in 1978. At many mines there were deviations from the annual program. Not put into operation on time were 26 longwalls with a possible extraction of 6,000 tons of coal, and 8 mines did not have the necessary reserve front of operations.

The plans were not fulfilled and there was a significant reduction in the volumes of preparatory operations by the associations Krasnoarmeyskugol', Dobropol'yeugol, and the Stakhanovugol' association reduced the tunneling volume by 61 kilometers with respect to 1970. The indicated associations operated unstably, and owed a great amount of coal.

It is necessary to solve fundamental problems directed at increasing the extraction of coal. The necessary conditions for fulfillment of the plan are timely and quality preparation of the line of working faces, and the presence of spare and reserve longwalls. In 1979 at each mine it is necessary additionally to prepare not less than one operating and one spare longwall. It is necessary to establish effective control over the introduction of the longwalls, and to increase the responsibility of engineering and production services. It is necessary to increase the number of tunneling brigades, which would insure the preparation of new mine faces. It is extremely bad that every year 50-60 percent of the underway layers are put into operation at the end of December. Foreseen in the plan for 1979 is their introduction every quarter, and especial attention has been given to setting up new layers at promising mines.

Under the conditions of an acute shortage of modern tunneling equipment only the organization of high-speed performance on the basis of large tunneling brigades will make it possible to reduce the times for preparing the longwalls and the layers, and to improve the mining.

In the case of a deficit of the extracting front at many mines utilized unsatisfactorily are the line of the working faces and the existing mining equipment. In a year the forward movement of the faces was reduced by 3.3 meters against the plan, the load on a working face was reduced by 16 tons and in the Sverdlovantratsit association by 106 tons, in Voroshilovgradugol' by 51 tons, in Shakhterskantratsit by 34 tons, and in the Torezantratsit association by 28 tons. The load on the fully mechanized longwall was also reduced. The low effectiveness of utilization of mechanized complexes is the result of unsatisfactory selection and preparation of the working faces, inadequate organization of production and labor in the extracting and in the repair shifts, and the poor state of the lead-in excavations and the ventilation. Repair shifts are not clearly discriminated at all mines, and they are not always provided with a staff of electricians. In the indicated shifts coal ex raction occurs, therefore there has been an increase in losses of working time due to accidents of machinery and mechanisms.

The schedules for installing timbering are not being observed, and the actual length of operations for installation and dismantling of complexes exceeds the norm 3-4-fold. At the "Yuzhno-Donbasskaya" Mine No. 1 (Donetskugol' Association) two complexes were being dismantled for almost a year. Complexes at the mines "Krasnoluchskaya" and imeni Frunze (Donbassantratsit) were in a state of collapse for about 9 months. The plan is not being fulfilled by 50 percent of the mechanized faces, and just during the year the production of coal was short by about 7 million tons. The leaders of the associations and the mines are obliged to be occupied deeply and concretely with questions of the work of fully mechanized faces, and an increase in the loads at the longwalls. Even just an increase in the load by 10 percent will insure an increase in extraction by 28,500 tons per day, or 9 million tons per year. This is the more important because provided by the plan for 1979 is a further increase in the rates of technical progress, especially regarding overall mechanization of operations in the working and preparatory faces.

The planned growth in the extraction of coal will be insured by the additional putting into operation of 50 complexes, by an increase in the load on the fully mechanized face by 5 percent on the average and by bringing it up to 660 tons per day.

The thousander-brigade movement is playing a large part in technical progress and in uplifting coal extraction. In a year 142 thousander-brigades put out almost 50 million tons of coal--a third of the working extraction on sloping beds. Such work will determine the results of the sector as a whole. The assignment regarding the number of longwalls with a daily load of 1,000 tons and more was not fulfilled by 13 associations, and 7 reduced the number of thousander-longwalls by comparison with 1977. The number of thousander-brigades was reduced considerably in the associations of Makeyevugol', Donbassantratsit and Sverdlovantratsit.

In our time, especial significance is taken on by the starts and initiatives of innovators of production, and of worker collectives. However the initiative of "Not one lagging nearby!" still has not received wide distribution. At the enterprises it is necessary constantly to introduce the advanced know-how of the best brigades, to increase the number of longwalls with a thousand-ton load, and to improve their operation.

Especial attention must be given to filling out the staff of workers of the basic occupations and correct utilization of labor resources. In many associations and at mines the workers of the working face, the tunnelers and cutters are often diverted for the fulfillment of non-basic operations, and in a number of cases there is nonfulfillment of the output norms, and there are great losses of time.

It is necessary for the leaders of the associations and mines to take urgent measures fur fillingin the staff of the basic occupations, to reduce to a minimum the diversion of workers from the working face and of tunnelers for performing outside processes, and to increase control over the status of the schedule system and reporting, and over visiting of the mines by managerial workers (especially during night shifts). It is necessary to provide order in each brigade, at each section and mine, to increase training work, to strengthen labor and production discipline, to raise the level of organisational work and to create the conditions for highly productive labor.

For a long time 32 mines have been operating with a lag, and in a year they were in debt about 4 million tons of coal. The actual average operating length of the line of the working faces for 20 of the mines (out of 32) was 1747 meters less than the planned length, at 10 of them there was not even one reserve longwall, and at the rest out of 49 reserve longwalls only 16 were provided with equipment. The downtimes for the longwalls which had not fulfilled the plan for a long time came to 22.1 percent, and taking into account the unproductive work (dismantling the barriers, crossing of geological breaks and others), they came to 30.2 percent of the shift time, which is 25 percent higher than the average data for the ministry. About 70 percent of the downtimes were caused by accidents with the digging machinery and recovery mechanisms, and malfunctions in intramine transport.

In construction the plan for capital inve tments and construction and installation operations is not being fulfilled. The work on reconstruction of the "Novo-Butovskaya" and "Yasinovskaya-Glubokaya" mines is being conducted extremely unsatisfactorily. Due to understaffing with workers, and the low level of engineering training at the mines imeni Kosior, imeni Vakhrushev, and No. 21, the plan is being fulfilled just by 75-85 percent. Mine building combines constantly carry over the deadlines for completing mine reconstruction, which places the associations in a difficult situation.

In 1979 it is necessary to put into operation 4 million tons of capacities for extraction of coal, including the first phase of the "Zapadno-Donbasskaya" mine No. 16/17 (capacity 1.5 million tons per year), the "Novomirgorodskaya" mine (1.4 million tons of brown coals), and to complete reconstruction of the mines "Novo-Butovskaya," imeni Vakhrushev and others. It is planned to build 856,000 square meters of living area against 719,000 square meters in 1978, to build children's preschool facilities for 3040 places, schools of general education for 5096 openings, hospitals with 250 beds and polyclinics to accomodate 600 visits, plus a 200-place recreation center.

The most important task of mine builders is to concentrate labor and physical resources at underway construction projects, to introduced the capacities for extraction of coal and facilities for social and cultural use in the outlined periods.

It is necessary for all enterprises, construction projects and organizations of the Ukrainian SSR Ministry of the Coal Industry to intensify the work for a saving of fuel and electric power, to wage a mass struggle for effective utilization of fuel and power resources in all labor collectives in the sector. Questions of safety engineering and labor protection should be at the center of attention. The leaders, the engineering and technical services of the mines and associations should increase the responsibility for performing mining and blasting operations, they should not allow violations of the timbering certificates, of the rules of operation of means of transport, the mine-face and stationary equipment, they should strictly watch over the status of the mine atmosphere and the gas-protection apparatus operation, and increase the exactingness toward the executives.

Great tasks are facing the scientific-research, planning and design institutes and organizations, and the plants in coal machine building, for which it is necessary to create new equipment, to modernize that in operation now, in order to raise the level of overall mechanization under complex mining and geological conditions, mainly on thin and steep beds, and also on beds with roofs that are hard to cave and unstable. It is necessary to follow the path of small-operation technology, insuring elimination of manual labor, and steady and effective work with taking the maximum possible number of people out of the excavation and preparatory operations. It. is necessary constantly to strengthen the relation between science and production, and the combined brigades, directly operating the equipment, and flexibly to introduce in the design of series-produced machines the improvements proposed by miners, which will insure reliability and quality of the equipment.

The miners and mine builders in the republic will use all their strength, knowledge and experience in order to fill with honor the tasks set forth by the 25th CPSU Congress and the 25th Congress of the Communist Party of the Ukraine, and by the November 1978 Plenum of the CPSU Central Committee, to insure fulfillment of the plan and the socialist pledges for 1979 and the Tenth Five-Year Plan.

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FUELS AND RELATED EQUIPMENT

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DELIVERY SYSTEM PLANNED FOR COAL INDUSTRY

Kiev UGOL' UKRAINY in Russian No 1, Jan 79 pp 17-19

[Article by candidate of technical sciences G.S. Pin'kovskiy and engineer M.S. Linetskiy, Dneprogiproshakht: "On Development of Plans for Packet-Container Freight Delivery in the Coal Industry"]

[Text] Packet-container freight delivery is the main direction in eliminating difficult manual labor in loading and unloading, warehousing and transport operations. The USSR Ministry of the Coal Industry has approved a program of planning, design and scientific research projects, the fulfillment of which will insure overall mechanization of operations regarding freight delivery from the supplier (sector subordination) to the job site in the mine. Fulfillment of the plans for packet-container delivery requires consideration of a number of features, and the accumulation of know-how, therefore the program provides for the development of normative and methodological documentation.

The operation of the packet-container delivery system and the greatest economic benefit can be attained only with mechanization of all links of the process of moving freight from the supplier-enterprises to the job site in the mine. For a correct economic evaluation of the outlays and determination of the advisability of introducing packet-container delivery, a technico-economic substantiation (TEO; tekhniko-ekonomicheskoye obosnovaniye) is worked out, performed for an individual association or a mine building combine in two stages: survey, study and analysis of the existing situation; development and economic evaluation of technical solutions. The actual status of production and the labor consumption of handling, warehousing and transport operations are established by surveying all the mines, central bases, warehouses, plants and other facilities supplying materials to the mines in the region. As a result of the surveys of the Pavlogradugol', Krasnodonugol' and Yuzhkuzbassugol' associations it was revealed:

The most labor-consuming operations requiring the use of manual labor are unloading, sorting, carrying up and loading of materials at the depots, warehouses and at the surface of the mine, the repeated transfers at the junctions of different types of intramine transport, dumping and storing of materials at the job site;

In view of the constant shortage of people for fulfillment of rigging operations on the surface and in the mine for delivery of materials, workers in the basic occupations (tunnelers and working face miners) are used, as a result of which there is a reduction in the rate of doing the excavation and moving the working faces ahead;

With the existing methods of delivery of materials and articles (mainly in bulk) and repeated transfers when transporting from the suppliers to the mine face, considerable losses occur. Thus, the breakage of reinforced concrete beams comes to 15-20 percent, losses of cement come to 12-25 percent, of reinforcements 5-7 percent, oil 18-20 percent, up to 15 percent of the rollers of belt conveyers are damaged, and so on.

On the basis of analysis of the existing situation in the technicoeconomic substantiation, a determination is made of the most economical and technically ideal schemes of the technological chain with the use of new equipment for each type or group of materials, beginning with putting them into freight units at the supplier-enterprise and ending with use at the job site, and also the connected reconstruction or erection of facilities. Solved are problems of concentration and specialization, and improvement of the organization of material and technical supply.

Considering the diverse nomenclature of materials, articles, spare parts and equipment (up to 24,000 designations) used by enterprises in the coal industry, the labor consumption and the economic inadvisability of their conversion to packet-container delivery, envisaged by the method at the given stage of development and introduction of the system is the separation of the materials and products used for mining jobs that are labor-consuming to deliver to the mine, and also the freight delivered in bulk and the freight that is labor-consuming to process at the depots and warehouses. For the separated products list a classification is compiled and a list of the basic materials to be covered by packet-container delivery is determined. The expected volume of consumption of materials is established based on the specific expenditure of them per 1,000 tons. Taken into account is the specific nature of delivery of the materials to the mines, during which two types of relations occur: supplier--mine warehouse; supplier--job site in the mine.

Provided for the first type of relation is the use of technical means of the all-union container transport system (KTS; konteynernaya transportnaya sistema), and for the second the means of the system of packet-container freight delivery in the coal industry ("Pakod" system).

Thus, "Pakod" supplements the KTS with respect to the specific nature of the freight utilised by the mining industry, and the transportation of it in underground mining excavations. The transit or warehouse form of delivery is selected in the case of the established territorial location of the supplier-enterprises taking into account the transport-procurement expenditures, the volume of consumption, the level of stocks, and the value of the transit and posted norms.

Calculated for the economic evaluation of the effectiveness of the "Pakod" system is the labor-intensiveness for each type of material in the whole volume of consumption in the case of different means of delivery taking into account all operations from the initial to the final point of movement of the material. For this tables are compiled of the technological operations of processing the freight at the depots, warehouses, on the surface of the mines, and during delivery of the freight through underground excavations, at the basis of which is the existing technology of operations and that proposed according to the "Pakod" system(figure 1).

The schemes of transporting freight through underground excavations in the case of packet-container delivery are worked out (for the purpose of comparison) for each mine applicable to the existing technology of conducting breakage and preparatory operations and to the condition of the excavations during the survey period. The labor-intensiveness of the operations for each type of material is determined according to existing norms, and the labor-intensiveness of the operations, for which norms of production are lacking, are determined according to time-study observations or approved mine estimations.

Stipulated by the method was the maximum utilization of existing warehouse sites, equipment and other physical resources for reducing the capital expenditure for introduction of packet-container freight delivery. Considering the necessity of a set period for assimilation of the "Pakod" system under the conditions of operating enterprises, envisaged is the introduction of packet-container delivery in two stages: fulfillment of priority projects for formation of the freight units at the depots, warehouses and plants and for mechanization of handling, warehousing and transport operations on the surface and in the mine; and the expansion of the field of application of packet-container delivery taking into account further centralization, specialization and improvement of the auxiliary production.

The effectiveness of packet-container delivery will be revealed by comparing the expenditures during realization of the "Pakod" system and the existing ones. Envisaged during performance of the technico-economic substantiation is the utilization of: a complex of equipment, devices and accessories of the "Pakod" system and the container-transport system (KTS); records of the freight units of materials and products; a method of calculation of the demand for means of

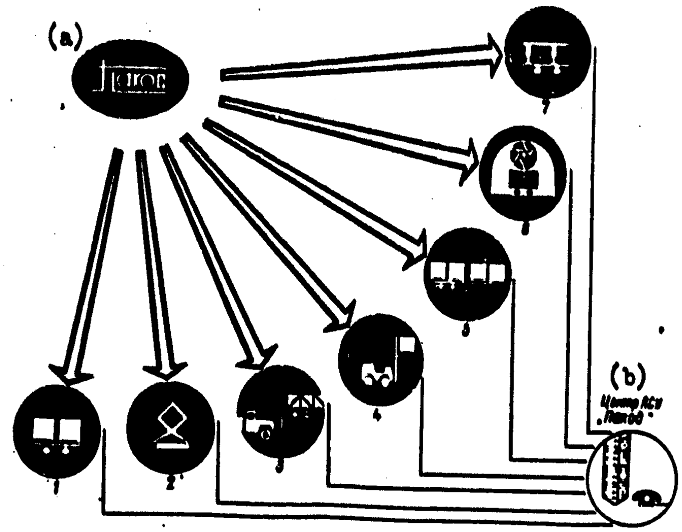

Fig. 1. Elements of the Packet-Container Freight Delivery System in the Coal Industry

Key:
1. Complex of equipment and apparatus for packet-container freight delivery, recording and control of their utilization
2. Complex of equipment, technology and organization of the formation of delivery units
3. Transport means and organization of packet-container shipments from the supplier to the warehouse
4. Warehouses and material-technical bases with mechanization of loading and unloading operations and an automated system of search, recording and control
5. Transport means, organization of shipments and transfer of delivery units to excavations
6. Organization of packet-container freight delivery during the making of excavations
7. Organization of packet-container freight delivery during extraction operations
a. Pakod
b. Pakod Automatic Control System (ASU) Center

packet-container delivery; the technical conditions of loading and transporting packet-container freight; the technological chain of formation, processing and transportation of a freight unit of each type of material from the supplier-enterprises to the job site in the mine.

According to the decisions made in the technico-economic substantiation design-estimate documentation (technical draft and working drawings) is developed for step-by-step introduction of the technology and equipment of packet-container delivery at individual objectives of the technological chain. In addition it is necessary to solve the problems of mechanization: formation of the freight units at the supplier-enterprises (plants for reinforced concrete products, repair and machinery plants, bases, central warehouses); handling and warehousing operations at the mine warehouses; transfers of packet-container freight by industrial transport from the supplier to the mine; intramine transport and transfer operations at the junctions of different transport links, and also questions of organization of the labor of basic production processes at the job site, dispatcher control, communications and organization of material and technical supply.

The type sizes and quantity of needed technical devices are determined by the plan for packet-container supply of the mine depending on the mining engineering conditions (systems of developments, mine gage, design and dimensions of lifting containers, type of the base car, links of intramine transport and others). Envisaged is the improvement of warehousing, providing overall mechanization of handling and warehousing operations; the needed front of hoisting and transport operations, regulation and preservation of materials owing to section rearrangement of the warehouses; equipment and the technology of mechanization of the transporting and reloading of auxiliary freight (including large-timber freight) with respect to underground excavations drectly to the job site.

A survey of the mines of different coal regions and basins (Leningradslanets, Vorkutaugol', Krasnodonugol', Yushkusbassugol', Rostovugol' and others) revealed the whole complexity and diversity of mining conditions and technical solutions adopted in the plans for erection and reconstruction of mines in the area of transportation of auxiliary freight.

The basic complexity and labor-intensity of working out the plans consists in that for each version it is necessary to find the optimum technical solution, making it possible to exclude manual labor through the use of the equipment of packet-container delivery. The decisions adopted in the plan must be considered and approved at technical councils of the production associations. In order to accelerate the introduction of the decisions made, creative cooperation is practiced: an institute develops the blueprints for an experimental model of a mechanism, and a production association manufactures it and does the experimental testing. Such an arrangement exists between Dneprogiproshakht and the associations of Krasnodonugol', Pavlogradugol, Gukovugol' and others.

An analysis of the results of the survey and the industrial tests of experimental models makes it possible for the scientific research and planning and design institutes to determine and accelerate the development and assimilation of the production of the necessary means of mechanization. After working out the standards and methodology documentation and industrial incorporation of the means and technology put into the plans, there is the possibility of creating standard plans of mechanization of handling, warehousing and transport operations of all links of the process of transferring freight from the supplier enterprises to the job sites in the mine on the basis of packet-container delivery. Introduction of the completed projects will make it possible to eliminate difficult manual labor, to increase 4-5-fold the productivity of labor at auxiliary operations, to eliminate breakage and losses of materials, and to reduce 5-6-fold the downtimes of transport means in freight operations.

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